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DENTAL CARIES

III. RICKETS IN RELATION TO CARIES IN THE DECIDUOUS AND IN THE PERMANENT TEETH

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HAROLD ABRAMSON, M.D.

AND

J. M. LEWIS, M.D.

NEW YORK

About two years ago we published a report in a journal of dentistry [1] concerning the occurrence of caries of the teeth among a group of children who had been carefully supervised, from a medical point of view, throughout infancy and early childhood. These children had been in a model institution until the age of 4 or 5 years, and had been carefully examined and tested for rickets as well as for the development of caries. At this age they had been discharged either to their homes or to other institutions for the care of children, where the condition of their teeth, especially of the deciduous and first permanent molars, was ascertained. The group comprised two sets of children: those who had had rickets during infancy, and others who had received the protective therapy of cod liver oil from the age of 1 month or 2 months. No child was included in the group unless he had been in the institution for a period of at least six months and had received cod liver oil throughout the winter. This group was unique from the standpoint of the combined medical and dental control of a group of children from earliest infancy until the eruption of the permanent molars.

It was thought worth while to follow these children still longer in order to ascertain the further occurrence of dental caries, as well as in order to add cases to the series. This seemed especially desirable because of the lack of data of this kind and of the need for clinical observations which might serve as a basis for coordinating knowledge in regard to diet during infancy with the soundness of the teeth during subsequent childhood. In addition to this study of the rôle of rickets as a factor in the etiology of caries of the deciduous as well as of the permanent teeth, an opportunity was provided of ascertaining whether the deciduous teeth of infants who had been admitted to the institution

From the Home for Hebrew Infants.

Presented before the Philadelphia County Medical Society, Feb. 24, 1932.

† Dr. Hess died Dec. 1, 1933.

1. Hess, A. F., and Abramson, H.: The Etiology of Dental Caries, Dental Cosmos **73**:849 (Sept.) 1931.

under the age of 1 year were less subject to caries than the teeth of children admitted subsequently, in other words, to determine whether the standard diet which the children receive while under our care exerts a favorable effect on the structure of the teeth.

Table 1 illustrates, in summary form, the extent of dental caries which developed in the deciduous and in the permanent first molars among children who had been protected as well as among those who had not been protected against rickets during infancy. The first group comprised 41 and the second, 47 children, each of whom had been carefully culled from a much larger group which, for one reason or another, was deemed unreliable and unacceptable. A glance at the comparative figures shows that in the children who had suffered from rickets, caries

TABLE 1.—*Comparison of the Incidence of Caries of the Deciduous and Permanent Teeth in Children Who Had Been Protected Against Rickets and in Those Who Had Not Been Protected* *

Group	Age, Years	Number of Children	Deciduous Molars			First Permanent Molars		
			Total Number	Carious		Total Number	Carious	
				Number	Per Cent		Number	Per Cent
Nonrachitic... ...	6-7	23	184	29	15.8	70	22	31.4
Rachitic.... ...	6-7	12	96	31	32.3	29	12	41.4
Nonrachitic.....	7-9	18	144	16	11.1	72	45	62.5
Rachitic.....	7-9	35	280	63	22.5	134	80	59.7

* Protection was afforded by three teaspoonfuls of cod liver oil daily, begun on the average at the age of 3 months and given until 11 months of age. A few children received, in addition, dried irradiated milk or ultraviolet irradiation; two were breast fed for ten months and eleven months respectively, and two received yolk of egg, but nevertheless had caries. One girl, aged 7 years, had received cod liver oil from the first to the twenty-fifth month, but nevertheless showed caries of two permanent molars. Of the children who had had rickets in infancy, two were more than 10 per cent below normal weight; of the nonrachitic children, three were below normal weight.

developed in the deciduous teeth to about twice the extent observed in those who had been protected by means of cod liver oil. It should be emphasized, however, that rickets is by no means the only etiologic factor, as exemplified by several children who received cod liver oil almost from the time of birth but in whom, nevertheless, caries of the deciduous molars developed during the third year of life. A deficiency of calcium and of phosphorus in the diet can be ruled out in this connection, for throughout the period of infancy practically all babies, and especially those who are bottle fed, receive an adequate supply of both of these salts in their milk.

When we considered the permanent teeth, we found that *caries developed in approximately 60 per cent of the permanent first molars of children from 7 to 9 years of age, whether or not they had been protected during infancy.* Indeed, it is seen that the incidence happens

to be somewhat higher for the group which had received cod liver oil. It may be that caries developed at a somewhat earlier age among the rachitic group. However, from the broad standpoint of the relationship of rickets to the etiology of dental caries of the permanent teeth, it must be regarded as inconsequential whether destruction of the dentin begins at 7 or at 9 years of age. It seems hardly necessary to illustrate the figures with an account of representative cases. One case, however, is so striking that it merits citation. This was the most severe case of rickets that had been observed in an inmate of the institution in the course of the past twenty years, one which is deserving of the old designation of "osteomalacic rickets." This child was admitted in June, 1919, at the age of 11 months, with rachitic and osteoporotic lesions of the bones of all four extremities. He was treated and cured by means of cod liver oil. The teeth of this boy, now about 13 years of age, were recently examined, and it was found that although some pitting, irregularity and malocclusion were evident, caries had developed in only one of the first permanent molars—a striking and perhaps significant phenomenon considering the intensity of the early rachitic process.

We shall not review our data in regard to the incidence of caries of the permanent molars among breast-fed infants, among infants whose mothers had received cod liver oil during pregnancy or among those who had been nursed and had received antirachitic treatment. These various aspects have been taken up in our previous paper, in which it was shown that caries developed in such children in spite of these various early protective measures. We may add that we have recent records of a child who had been breast fed for eleven months and had received cod liver oil, of another infant who had been breast fed for seven months and had been treated with ultraviolet rays from a mercury vapor lamp, and of still another who manifested four carpal centers at the age of 9 months, had been breast fed for ten months and received very large amounts of milk throughout childhood—in all those children caries developed in four permanent molars by the age of 7½ years. We shall return to this subject later.

An opportunity was afforded of approaching this question of the relationship of rickets to dental caries from a different point of view. The Tuberculosis Preventorium for Children at Farmingdale, N. J., cares for nontuberculous white and Negro children. The latter come from two of the poorest districts of New York. As is well known, not only are Negro infants especially susceptible to rickets, but the condition develops in them in especially marked degree. Such being the case, it seemed as if a comparative survey of the occurrence of dental caries among the Negro and the white children of this institution would be of value. The children selected for this survey were from 8 to 14 years

of age (table 2). Their infancy dated back to the period when cod liver oil or some other antirachitic therapeutic agent was given only to a very slight extent in the districts in which they had lived. As a matter of fact, a field study was carried out in one of these Negro districts at about that period [2] in order to test the efficacy of cod liver oil as an antirachitic agent. It showed that almost all infants suffered from rickets in greater or lesser degree. It was therefore most instructive to discover that, as may be seen from table 2, less caries was found among the permanent molars of the Negro children than among those of the white children. Cavities or filled teeth were present in 65 per cent of the Negroes and in 84 per cent of the white persons; the ratio was similar for the younger and older groups. Such data indicate that some important factor other than infantile rickets must be involved in

TABLE 2.—*Comparative Incidence of Caries of Permanent Molars Among a Group of White and of Negro Children*

	Age, Years	Number of Children	Teeth		
			Sound	Carious	Percentage of Carious
White	8-11	106	16	90	85
	11-14	94	16	78	73
		200			84
Negro	8-11	132	38	94	71
	11-14	68	32	36	53
		200			65

the development of dental caries. There is a factor, most fittingly designated at present by the term "constitutional," which, although admittedly vague, has to be taken into consideration in the etiology of rickets and, it would seem, of tooth resistence. In this connection it should be pointed out that the teeth as well as the bones of the Negro generally are heavier than those of the white man.

In view of the fact that our results showed an increased incidence of caries of the deciduous teeth in contradistinction to those of the permanent teeth of children who had suffered from rickets during infancy, it seemed highly desirable to investigate this aspect further and from another point of view. To this end a study was made of the occurrence and incidence of caries in the deciduous teeth of all children who had been inmates of the institution during the past ten years. Data for the elucidation of this subject were readily available as throughout this period our visiting dentist, Dr. Samuel Pemsler, regularly examined the teeth of all the children and charted the condition of the enamel, dental structure, gums and other parts. The method of procedure was to note

2. Hess, A. F., and Unger, L. J.: Prophylactic Therapy for Rickets in a Negro Community, J. A. M. A. **69**:1583 (Nov. 10) 1917.

the age at which a child first showed signs of caries in one or more of the deciduous molars and to ascertain the relationship of this phenomenon to the age at which it had been admitted to the institution. It was felt that a compilation and study of these data, which are incorporated in table 3, should enable one to judge whether a distinction could be drawn in regard to susceptibility to caries, between children who had been admitted to the institution during the first half year or the first year of life and those who had been admitted during the second and third years. The age of 4 years was set as the terminus, as this is the age limit for children in the institution. A review of the notations covering the 1,167 children which form the basis of this study shows that at the fourth year the percentage of caries among children who had been admitted during the first year of life is almost nil, and that it

TABLE 3.—*Relationship of Age of Children on Admission to the Institution to the Subsequent Development of Caries in the Deciduous Teeth*

Age on Admission, Years	Total Number Admitted to Institution	Number Showing Caries by Fourth Year	Caries, per Cent
0–½	280	1	0.4
½–1	129	3*	2.2
1–2	250	21	8.4
2–3	284	35	12.0
3–4	224	43	19.1
	1,167	103	

* Two were admitted at 11 months of age.

increases steadily, year by year, the later the children enter the institution. Among 409 admitted during early infancy, before the age of 1 year, only 4 were found to have caries from three and a half to four years later, whereas among 224 admitted between 3 and 4 years of age, 43 showed signs of caries of the deciduous molars.

In the only positive case in a child admitted under the age of 6 months, there were definite signs of rickets, although cod liver oil was given from the age of 6½ to 16 months. The child proved to be mentally backward. Of two children admitted during the latter half of the first year, one had, according to the notation, "very marked bowing of the legs" without other evidences of rickets; it was admitted at 9 months of age and did not receive cod liver oil. Another child was admitted at 11 months, weighing 19 pounds (8,600 Gm.), and never showed evidences of rickets, although it likewise did not receive cod liver oil. At 3 years of age it had three cavities, which were filled.

It is evident that, whatever may be ascribed as the cause, in children brought up from earliest infancy in this institution caries of the deciduous teeth developed to a less degree than in those who entered later in childhood. In the light of our previous study we attribute this comparative lack of resistance, certainly in part, to infantile rickets. It so happened that the ten year span embraced by this survey fell, from a

therapeutic point of view, into two general periods: the one covering the years from 1921 to 1926, during which antirachitic preparations, or rather calcifying agents, were given only occasionally and irregularly during the first year of life, and the other covering the five years from 1926 to 1931, during which cod liver oil or some other calcifying agent was given as a routine measure. Although this division into two groups cannot be sharply drawn, it is interesting to note that in the children in the latter group caries developed to a less degree than in those admitted in the earlier period. It could also be mentioned that in the children who were admitted between the ages of 2 and 4 years caries developed less often in those who were admitted during the period from 1926 to 1931. This difference we attribute to the marked increase in the use of antirachitic agents throughout the community. It is quite possible that factors other than infantile rickets, perhaps prenatal, played a rôle in the caries of the deciduous teeth occurring among children who were brought to our institution after the first year of life. It should be borne in mind, however, that during the first year of life the feeding of infants is much the same within and without institutions. Certainly the consumption of milk, which involves the intake of calcium and phosphorus, is no greater in the institution than in the home. It may be added that after the age of 18 months our dietary includes about 20 ounces (567 Gm.) of milk daily, an egg three times a week, vegetables, butter, cereal and 1 ounce (28 Gm.) of orange juice daily—in other words, a diet which is not superior to that which a young child receives, except in time of economic stress, in the average home. Any distinction which does exist is certainly not in the daily quota of milk.

In considering the question as to whether rickets is a factor of importance in the etiology of dental caries insufficient attention has been paid to the chronology of calcification of the teeth. This aspect was made the object of extensive roentgenologic study in our institution.[3] Without entering into the details of the course and sequence of calcification of the deciduous and permanent teeth, two outstanding points may be emphasized in connection with the present study. They are clearly brought out in the accompanying illustrations: The first is that the crowns of the permanent first molar teeth, instead of being calcified at birth, as is commonly stated, do not undergo calcification until about the sixth month of life. It will be noted that even then only the peaks of the cusps are calcified (fig. 1). Although these teeth may be involved in a rachitic disorder, evidently the calcification of their crowns occurs after the peak of incidence of rickets. This observation might be con-

3. Hess, A. F.; Lewis, J. M., and Roman, Benjamin: A Radiographic Study of Calcification of the Teeth from Birth to Adolescence, Dental Cosmos **74**:1053 (Nov.) 1932.

sidered to leave the question of rachitic involvement of the permanent molars open to twofold interpretation. But what are we to conclude when we find that *the permanent second molars do not undergo calcification until the child is 3½ or 4 years of age* (fig. 2), a period of life at which rickets is scarcely ever encountered? In our opinion, this phenomenon, which is regular and reliable, constitutes the second cogent argument against the dominance of rickets in dental caries, for we must remember that the second permanent molars undergo caries to almost, if not quite, the same extent as the first permanent molars; in other words, that it is exceptional to find them sound.

Fig. 1.—Roentgenogram at 1 year of age (anatomic specimen) showing calcification of the cusps, but not of the body, of the first permanent molar tooth.

Fig. 2.—Roentgenogram at 3½ years of age showing beginning calcification of the cusps of the second permanent molar tooth.

Before leaving this subject of the relation of rickets to dental caries, we want to call attention to a few significant observations of other authors. In a recent report Anderson [4] stated that only 25 per cent of the men from the Province of Shansi, China, which is notable for the occurrence of osteomalacia, so well described by Maxwell and Miles, were found to have dental caries. Again, the fact that dental caries is as frequent and as severe in the tropics, where rickets is rare and very mild, as in the temperate zones necessitates a broader etiologic point of view. In Jamaica, for example, with yearly sunshine of about thirty-one hundred hours, comparable to that of Cairo, Egypt, 80 per

4. Anderson, B. G.: A Study of the Incidence of Dental Caries in One Thousand Chinese, J. Dent. Research **12**:709 (Oct.) 1932.

cent of the school children were found to have dental caries.[5] Although such experiences should not be interpreted as indicating that sunlight is of no protective value—in Jamaica there was a marked lack of calcium in the dietary—they do indicate that it is not the controlling factor, and that the suppression of rickets, whether of the infantile or of the osteomalacic type, will not result in the suppression of dental cares.[6]

COMMENT

The only report which has considered dental caries from the point of view of rickets in infancy is that of Mackay and Rose,[7] which appeared shortly after our preliminary paper. These investigators studied the teeth of children from 6 to 10 years of age, "who are known to have had rickets in infancy or early childhood," and compared them with the teeth of a control group of children of about the same age. They found that "the amount of caries in the permanent teeth appeared only slightly greater in the rachitic group than among the controls" and that "the amount of caries of the temporary teeth was about the same in the rachitic and control groups." These conclusions are almost the same as ours as to the effect of infantile rickets on the permanent teeth, although they differ in the observation that infantile rickets did not lead to caries of the deciduous teeth. The divergence may well have been due to a dissimilarity in the diet or in the intake of vitamins subsequent to the rachitic age. There are other interesting studies which concern themselves with somewhat different but closely allied phases of this problem. The first is that of Boyd and Drain,[8] who found that "the intake of a diet rich in mineral salts and vitamins resulted in arrest of

5. In regard to the relation of scurvy to dental caries, the following statement gives the experience of Lind (Lind, James: Treatise on the Scurvy, ed. 3, London, T. Becket, 1772), the great authority on scurvy in the eighteenth century, when this disorder was rife throughout the British Navy and Mercantile Marine: "It is rare to find a carious jaw after the most virulent ulcers in the gums, unless by some accident, as the pulling out of a tooth, or part of the lamella of that bone has been broken. In the same manner, the teeth will likewise be preserved sound if their outer coats are entire."

6. Sufficient attention has not been directed to a study of normal dentures. This aspect is generally confined to references drawing attention to the excellent teeth of the Eskimo. Much might be learned from controlled investigations in regard to children with sound permanent teeth whose early history is ascertainable as to diet and nutrition. Physicians, especially children's specialists, have exceptional opportunities to make observations of this kind, and these observations could be amplified by data concerning the children of physicians.

7. Mackay, H. M., and Rose, S. F.: Vitamin D Deficiency, Dental Caries and Tonsillar Enlargement, Lancet **2**:1230 (Dec. 5) 1931.

8. Boyd, J. D., and Drain, C. L.: The Arrest of Dental Caries in Childhood, J. A. M. A. **90**:1867 (June 9) 1928. Boyd, J. D.; Drain, C. L., and Nelson, M. V.: Dietary Control of Dental Caries, Am. J. Dis. Child. **38**:721 (Oct.) 1929.

dental caries in a group of twenty-eight well controlled diabetic children." This study was followed by one of similar nature which again showed that by giving a dietary that is adequate or even excessive, as judged by established nutritional standards, caries may be arrested. A clinical study was carried out by Mellanby and Pattison;[9] it differed from the former in that an ordinary institutional dietary was given, which was fortified for one group of children by the addition of preparations containing vitamin D. By means of this clinical test it was convincingly shown that these specific additions to the diet "checked the initiation of new carious points and diminished the spread of old carious points." These results have been confirmed and extended by Mellanby in more recent work.[10] An investigation in the same field was reported some two years ago by Bunting and his co-workers;[11] the scope of those observations is indicated by the title, "A Report of the Successful Control of Dental Caries in Three Public Institutions." Still more recently a convincing study, "tending to confirm the theory of the importance of diet as a factor in the nutritional control of dental caries," has appeared in the dental literature. In this investigation McBeath[12] used a dietary similar to that of Boyd and Drain whose work he was able to corroborate.[13]

The apparent conflict between the opinion expressed by others and the stand which we have taken revolves about differences in the conception of the relation of rickets to calcification. We do not believe that rickets is a factor in the etiology of caries in the permanent teeth but rather that caries is due to faulty calcification which occurs later in childhood. Therefore, it is in our opinion, highly desirable to include a calcifying agent in the dietary throughout childhood and early adult life

9. Mellanby, May, and Pattison, C. L.: The Action of Vitamin D in Preventing the Spread and Promoting the Arrest of Caries in Children, Brit. M. J. **2**:1029 (Dec. 15) 1928.

10. Mellanby, May, in Influence of Diet on Caries in Children's Teeth, by Committee upon Dental Disease, Medical Research Council Special Report, series no. 159, London, His Majesty's Stationery Office, 1931.

11. Bunting, R. W.; Jay, Philip, and Hard, D. G.: A Report of the Successful Control of Dental Caries in Three Public Institutions, J. Am. Dent. A. **18**:672 (April) 1931.

12. McBeath, E. C.: Experiments on the Dental Control of Dental Caries in Children, J. Dent. Research **12**:723 (Oct.) 1932.

13. Mention should be made of the striking experimental results recently reported by Hoppert and his colleagues (Hoppert, C. A.; Webber, P. A., and Canneff, T. L.: The Production of Dental Caries in Rats Fed an Adequate Diet, J. Dent. Research **12**:161 [Feb.] 1932). These workers found that when rats were fed a coarse food, which led to the retention of particles between the teeth, caries resulted, quite independent of the calcium and phosphorus content of the ration. A result such as this indicates that, in considering the problem of dental caries, the local factor must be taken into account.

in order fully to protect the teeth. Calcium and phosphorus should be provided so that the vitamin may function properly; in fact, this is one of the main reasons why we favor the extended use of irradiated milk throughout childhood and early adult life. This point of view in regard to the calcification of the teeth and the rôle of calcifying agents would seem to account for many apparent divergences which are to be found in the voluminous literature on the relation of rickets to dental caries.

A factor which has served to confuse this question is the use of the term "antirachitic vitamin" for a vitamin which is by no means restricted in its action to the prevention or the cure of rickets. A more precise designation would be "calcifying vitamin," as, provided an adequate supply of calcium and phosphorus is furnished, this specific factor brings about calcification, irrespective of whether the deficient calcification is due to rickets or to other nutritional disturbance. In regard to bone, this point is well exemplified by osteoporosis, in which the rapid calcification is brought about by therapeutic agents furnishing vitamin D, provided growth is not at a standstill. One sees little more reason for continuing the narrowly restricted term "antirachitic vitamin," which served a temporary purpose, than for insisting on the designation "anti-beriberi vitamin" for vitamin B.

CONCLUSIONS

A study was carried out in an institution on a group of children who had been carefully observed throughout infancy, from a dental as well as from a medical point of view. One group had been definitely protected against rickets by means of cod liver oil or some other calcifying agent, whereas the other group had had infantile rickets. At the age of from 6 to 9 years, it was found that caries had developed to a greater extent in the deciduous teeth of the "rachitic group" than in those of the "protected group." The permanent teeth, however, showed caries to about the same extent in both groups.

The development of caries of the deciduous teeth, during a ten-year period, in children raised in an institution was found to be far less for those admitted during the first year of life than for those admitted during the second or third year. This favorable result is attributed largely to the fact that the children in the institution had been given a calcifying factor.

The permanent teeth of a group of Negro children, from 8 to 14 years of age, were examined for caries. These children had been brought up in the districts of New York City which, in the period of their infancy, were scourged with rickets to the greatest extent. Nevertheless the dentures of these children were superior to those of a similar group of white children from New York.

Caries of the permanent teeth is not due to infantile rickets but to a nutritional disturbance occurring in childhood and early adult life. The first permanent molar teeth do not undergo calcification until late in the rachitic period, and the second permanent molars, which are likewise markedly subject to caries, do not calcify until far beyond this period.

The antirachitic vitamin, which more properly may be designated as "the calcifying vitamin," is of value throughout the period of growth in fortifying the structure of the teeth and bones.

POSTURE

A STANDARD FOR ANTERIOR POSTURE

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PORTLAND, ORE.

The Golden Age of Greece was marked by an endeavor to produce a people physically fit. The statuary of the fifth century B. C. still represents the best to be found anywhere, not only in art, but also in physical perfection of form. "A sound mind in a sound body" was their slogan and their standard. During the Victorian era the reverse idea prevailed, that a weak or crippled body fostered greatness of mind and soul. From this false premise the pendulum has swung far so that today, more than at any time since the days of classic Greece, one finds a general interest in bodily perfection. Perhaps no small factor in this renaissance is the modern style of dress. The body must be seen to be appreciated. When all sorts of defects could be concealed under bustles, flounces and false fronts, no one cared much what the body was like. When women wore such long skirts that their toes played hide and seek with the outer world, I remember wondering in my boyish mind whether women really had legs like men.

In those days, too, one was taught to throw the shoulders back, and to stand and walk with the feet at an angle of 45 degrees, in blissful ignorance of the fact that this produced sway-backs, pot bellies, pelvic distortion, lumbar pain and flat feet. Today the prevalent debutante slouch indicates an equal lack of knowledge of the fundamentals of proper posture.

Esthetics is a strong stimulant, stronger than a vague promise of better health. The requirements of health and beauty combine to demand the finest physical type. The physician's attention has been so centered on illness, from colic to cancer, that posture is perhaps the least cultivated field in the range of pediatrics.

A discussion of standards of posture therefore appears timely. Previous papers on body mechanics by Coe [1] and Wiggins [2] indicate

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From the Nutritional Research Laboratory, University of Oregon Medical School.

Read before the North Pacific Pediatric Society at Seattle, Washington, Jan. 28, 1933.

1. Coe, H. E.: Postural Defects in Children, Northwest Med. **26**:94 (Feb.) 1927.

2. Wiggins, R. H.: The Management of Posture in Children, Canad. M. A. J. **24**:820 (June) 1931.

the interest in this subject. Since the public has become aroused also, do they not need encouragement and assistance?

In the literature at my disposal, the White House Conference report on body mechanics is the most comprehensive. The following quotation [3] from it challenges all physicians, especially pediatricians: "The average general practitioner has been insufficiently informed and is consequently not vitally interested in body mechanics." The results are given of a study conducted by means of a questionnaire sent to 1,017 pediatricians. Among the 925 responding, 67 per cent reported that they "always" looked for poor body mechanics and faulty posture. This in itself is a highly commendable percentage, or, rather, it would be were it not for the admission of 50 per cent of these men that they did not feel competent to give corrective instruction. It is altogether probable that many were thinking only of severe forms of body deformity which require the care of a specially trained orthopedist.

The field for work on posture includes every child from birth through puberty. Perfect posture implies a perfect form. That form is dependent on posture is an undisputed fact. A weak body can be strengthened by correct posture, and without it even a strong body cannot be perfect. Muscles, nerves and vital organs, not to mention disposition, energy, and endurance, are all affected by the posture of the body.

Borden Veeder [4] says:

> Posture is one of the most important subjects connected with the physical development of the child. No matter whether the internal organs be sound, the weight for height average, and the annual gain in weight and height satisfactory, the physical development of the child cannot be considered satisfactory if the posture is bad. The majority of adults have a poor posture as a result of neglect in childhood.

Schwartz,[5] in an excellent summary of the literature up to 1927, including 154 books and articles, says: "There is a lack of agreement in the various definitions of standards and tests for good posture." Perhaps this is one reason for the lack of interest brought out by the questionnaire already referred to.

Brown [6] of Harvard deserves credit for developing a simple standard for profile posture which has become well-nigh universal in this

3. White House Conference on Child Health and Protection: Body Mechanics: Education and Practice, New York, Century Company, 1932, p. 30.

4. Veeder, Borden S.: Preventive Pediatrics, New York, D. Appleton and Company, 1926, p. 32.

5. Schwartz, Louis: A Résumé, with Comments, of the Available Literature Relating to Posture, Pub. Health Rep. **42**:1219 (May 6) 1927.

6. Brown, Lloyd T.: A Combined Medical and Postural Examination of 746 Young Adults, Am. J. Orth. Surg. **15**:774 (Nov.) 1917.

country, thanks to its general distribution by the Children's Bureau and its repeated use in medical publications. Brown introduced four grades of posture, using the words excellent, good, poor, bad, and representing these with the corresponding letters A, B, C, D. For grading children, a chart 3 (91.44 cm.) feet square, large enough to be seen across a room and to show important differences plainly, is almost necessary. A diagrammatic outline illustrating the location of

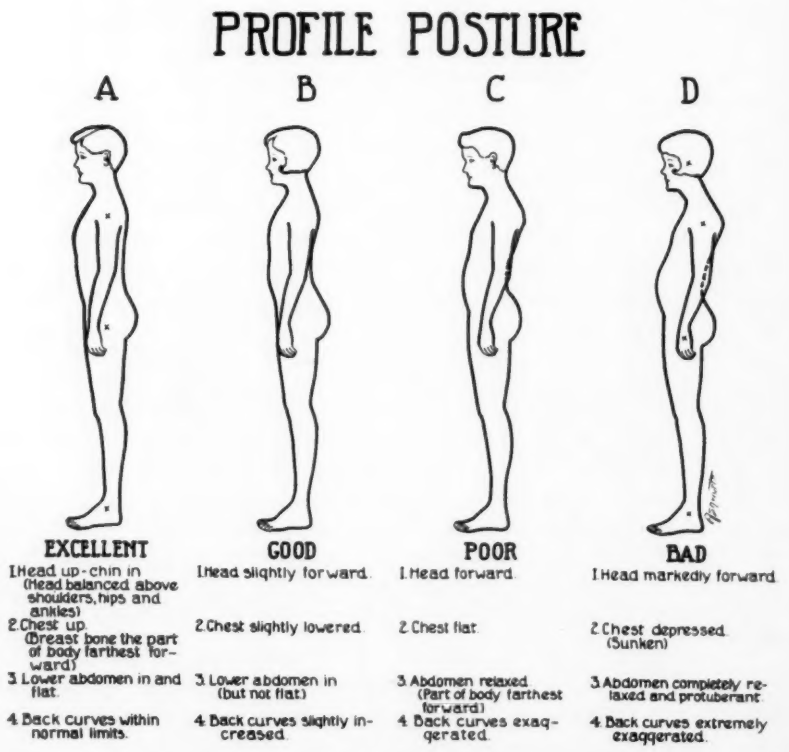
PROFILE POSTURE
A
B
C
D
EXCELLENT
1. Head up - chin in (Head balanced above shoulders, hips and ankles)
2. Chest up (Breast bone the part of body farthest forward)
3. Lower abdomen in and flat.
4. Back curves within normal limits.
GOOD
1. Head slightly forward.
2. Chest slightly lowered.
3. Lower abdomen in (but not flat)
4. Back curves slightly increased.
POOR
1. Head forward.
2. Chest flat.
3. Abdomen relaxed. (Part of body farthest forward)
4. Back curves exaggerated.
BAD
1. Head markedly forward.
2. Chest depressed. (Sunken)
3. Abdomen completely relaxed and protuberant.
4. Back curves extremely exaggerated.

Fig. 1.—For a profile grade of *A* the external auditory meatus, tip of acromial process, greater trochanter and external malleolus fall in a perpendicular line.

the ears, arms and shoulders is, in my experience, more easily comprehended than silhouettes. My associates and I obtained the first chart of this kind in 1924. Its crudeness and anatomic imperfections have been corrected by C. Ashworth, artist for the University of Oregon Medical School (fig. 1).

It is noteworthy that for a grade of A the external auditory meatus, acromial process, the great trochanter and the external malleolus (or its anterior border, in adults) fall in the perpendicular. A plumb line applied to a person with a D posture would rarely strike more than two

of these cardinal points. Parents and older children readily remember these four points and willingly strive for their alinement. The letters C.O.B.I. (chest out, belly in) further emphasize the ideal and aid the memory. At puberty girls need to be informed that it is the breast bone, not the breasts themselves that should be farther forward than the abdomen.

The degree of the sway-back can be most easily determined by having the individual stand with the shoulders and buttocks touching a wall and with the heels a distance of 2 (5 cm.) or 3 inches (the width of one heel) away from the wall. Standing in this position, with the chest out and abdomen in, the back at the waistline should be so close to the wall that the fingers can barely be inserted between the two. It is easy for a child to make this test on himself, especially if his parents give him encouragement and assistance in grading.

Most adults were taught to throw their shoulders back, thus producing sway-backs. With a little practice even grandparents are able to flatten their backs against the wall and to walk away holding the body in this position. One must, of course, wear heelless or low-heeled shoes to obtain and maintain a proper profile posture. Drew [7] accurately stated that when the chest is up, chin in and back straight, the anterior and posterior groups of antagonistic muscles hold the body erect with the least amount of strain.

After applying standards of profile posture for a time one realizes that proper posture is more than a one-sided affair. Is not an anterior study just as essential as a lateral? A child having a grade of A for profile posture may have one shoulder higher than the other, unequal curves at the waistline, knock knees or bowlegs or flat feet, none of which defects is visible in a lateral view. Persons with such defects are not uncommon. Should such a person be considered to possess a perfect posture? Do not two points of view demand two types of standards? This question arises forcibly during the careful grading of large groups of school children.

One of the difficulties encountered in making diagrammatic representations of anterior postures is the depicting of genu valgum or genu varum and varying degrees of flatfoot in the same picture. Realizing that children need simple standards that will, as far as possible, enable them to grade themselves when standing in front of a mirror, we finally evolved the diagrams shown in figure 2. As the letters A, B, C, and D are used to represent excellent, good, poor and bad grades for the profile view, the Roman numerals I, II, III, IV were selected to represent similar forms for anterior views.

7. Drew, Lillian C.: Individual Gymnastics, Philadelphia, Lea & Febiger, 1929, p. 36.

During examination the arms hang easily at the sides and the feet are placed parallel to and touching each other. For a grade of I a perpendicular dropped from the nose falls through the suprasternal notch, the navel and the space between the feet. The curves at the waistline are equal and the shoulders of equal height. The knees, ankles and great toes touch their mates easily, with visible spaces above and below the internal malleoli.

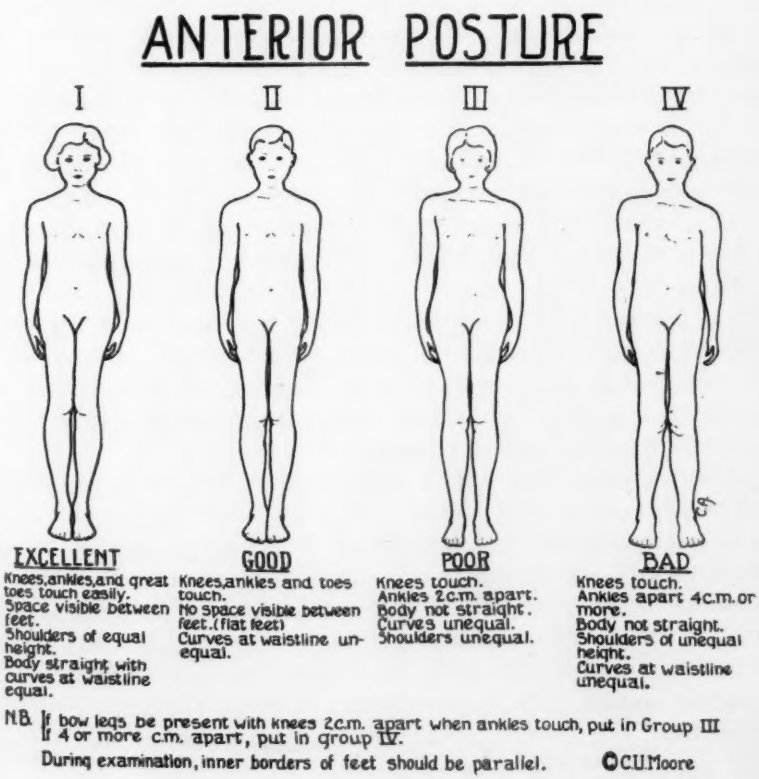

Fig. 2.—An anterior posture grade of I requires that a perpendicular dropped from the nose shall fall through the suprasternal notch, the navel and the open space between apposed feet.

The examiner's hand may be inserted between the knees to ascertain the presence of undue pressure indicative of genu valgum or of excessive space showing genu varum. Tailors have used this method since time immemorial. If knock knees are present, separate the feet until the knees touch lightly, then measure the distance in centimeters between the internal malleoli. If this distance is approximately one fingerbreadth (1 cm.) the posture grade would be II, especially if any

other variation from type I exists. With ankles apart 2 cm., plus or minus 0.5 cm., the grade would be III, and if apart 4 cm. or more the grade would be IV. Similarly for bow-legs, if the internal malleoli touch and the knees are 2 cm. or 4 cm. apart, a grade of III or IV is given. Since faulty posture is primarily skeletal in origin,[8] the trunk, as well as the legs and feet, will usually show some malformation, especially in grades III and IV. For example, the shoulders and the waistline curves probably will be unequal.

Grades I and II can usually be differentiated by the feet. Do the scaphoid tubercles touch? If not, visible space is present for the entire distance between the arches, from the internal malleoli to the bases of the great toes, except in cases of edema or obesity. When one remembers that the scaphoid (navicular) bone is the keystone of the longitudinal arch of the foot one appreciates the importance of this space between the scaphoid tubercles as a measure of flat feet. In children the scaphoid bone frequently slips in and out with every step. This is easily demonstrated to a parent by having the child rise on his toes, then settle slowly back on the heels, noticing meanwhile that these keystone bones roll toward each other.

Although these diagrams may not be perfect, the differences in posture are easily seen and the grading consequently simplified. They have been used for two years in the examination of several hundred children and have proved practical for rapid work and invaluable for effective teaching.

In general, our experience indicates that a large majority of children, approximately 75 per cent, will fall in the C III group, i. e., get a C, or a III, or both. About 20 per cent are graded D IV; 4 per cent, B II, and less than 1 per cent A I. Additional experience or more liberal grading may markedly alter these percentages. Occasionally an individual is found with a grade of C I or A III, but we have not seen such contrasts as D I or A IV.

Many who have a practically perfect posture in profile will be graded II for the anterior view, as in the case of the girl shown in figure 3. Her back is straight and fits flat against the well, the sternum is farther advanced than any portion of the abdomen, and the four cardinal points fall in a perpendicular line. This girl stood and walked thus, even when not being examined. She has the most natural and

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8. McCollum, E. V., and Simmonds, Nina: The Newer Knowledge of Nutrition, ed. 3, New York, The Macmillan Company, 1925, p. 376, fig. 16. Hess, A. F., and Blackberg, S. N.: An Experimental Study of the Constitutional Factor in the Etiology of Rickets, Am. J. Physiol. **102**:9 (Oct.) 1932. Moore, C. U.: Rickets of the Lower Extremities: Its Relation to Genu Valgum and Static Flat-Foot, J. Bone & Joint Surg. **10**:96 (Jan.) 1928; Nutrition of Mother and Child, ed. 3, Philadelphia, J. B. Lippincott Company, 1927, p. 55.

unassumingly perfect profile I have ever seen. Her anterior posture is likewise perfect in every way except in the arches of the feet, which roll together and obliterate the normally open space extending from the internal malleoli to the great toes. This girl won both the Oregon state contest and the interstate 4H Health Club contest for 1932. Her grade for posture was A II.

A girl who won in similar contests in 1929 with a grade of B I is shown in figure 4. It is noteworthy that the legs and feet are prac-

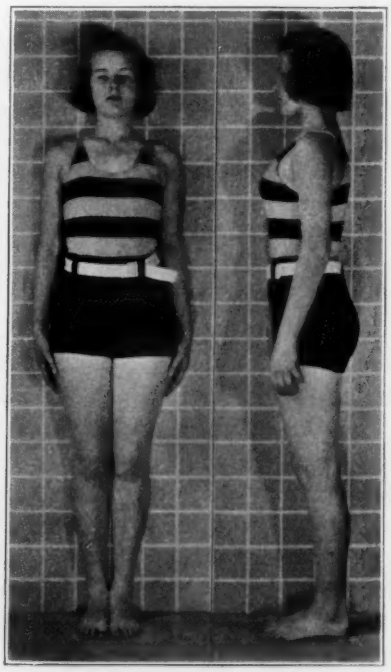

Fig. 3.—Photograph of a 4H Health Club girl with a perfect profile posture (grade *A*), and with anterior posture marred only by the lack of space between the arches of her feet (grade II).

tically perfect, with good space between the arches. When her picture was taken in profile she threw her shoulders back suddenly as if she had been taught to do so. This view therefore represents her as having more sway-back than she normally has.

A single lesson sometimes suffices to impress on the mind of a child the essentials of proper posture. However, follow-up work is usually as necessary as reviews of the arithmetic lesson. The exact posture and degree of improvement may be accurately recorded by photographs taken with the child standing in front of and touching a

cross-lined background. Such a surface could be painted on the wall behind a blind door in the office, if possible 12 feet (396 cm.) from the location of the camera. White lines on a gray surface crossing each other so as to form 4-inch (243.84 cm.) squares make a good background (fig. 4). With this arrangement two photographs are necessary to obtain front and side views. A full-length mirror placed at an angle of 45 degrees to the screen, as suggested by Clough and Murlin,[9] would give both views in a single picture. Our posture pictures are

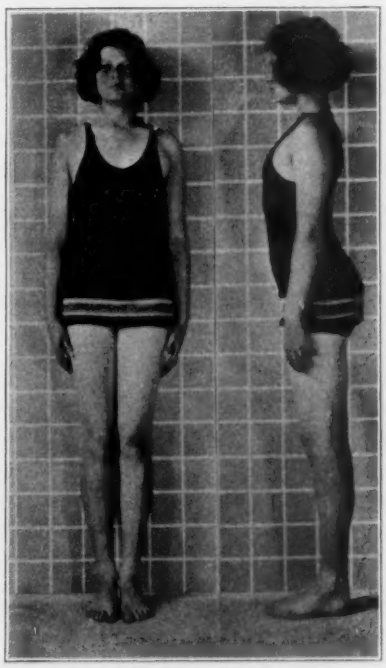

Fig. 4.—Photograph of a girl with profile posture grade of *B* and anterior posture grade of I (no flatfoot).

postcard size, autographic, taken with an ordinary camera. A print, on the back of which are recorded the name, date, height, weight and grading for posture is furnished to each child. The gift to each family of a small copy of the charts for study at home assists in clarifying the grade given and in arousing additional interest.

Since varying degrees of flat feet can hardly be indicated in simple outlines of the whole body, one may represent such variations by the

9. Clough, H. D., and Murlin, J. R.: Permanent Records of Growth and Nutrition in Children, Am. J. Dis. Child. **36**:425 (Sept.) 1928.

small letters a, b, c and d. The space between the arches of the feet may be only partially obliterated, as when the tubercles of the scaphoid bones barely touch, or the arches roll together for half or three fourths of their length. Grading the arches may seem an unnecessary refinement, but it has a certain practical value. A child who must wear one-eighth inch to one-quarter inch lifts (leather wedges) under the inner border of his heels for the usual period of from three to five years is greatly encouraged by a slight change in grade, e. g., from A II to A II c.

A diagrammatic picture of the way in which the bones of the feet are deranged when flatfoot occurs has proved helpful in securing cooperation of the parents in encouraging corrective measures (fig. 5).

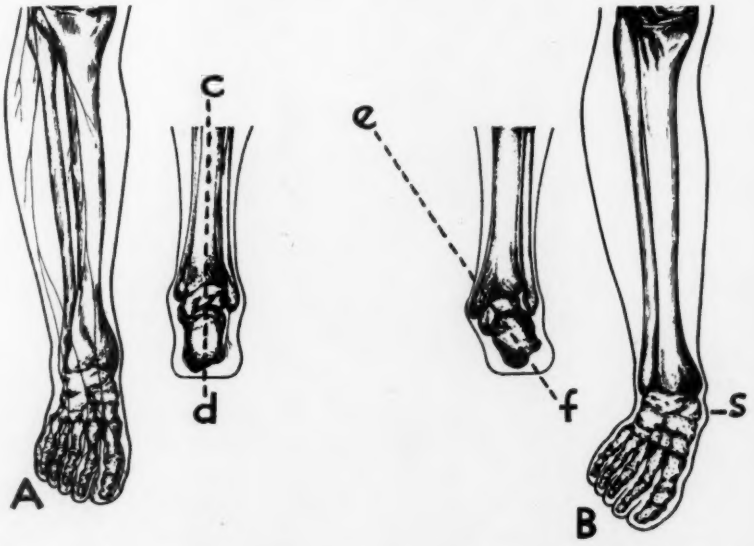

Fig. 5.—Diagrammatic comparison of the bony relationships in a perfect foot *A*, with those in a "flat" foot. Note that in *B* the scaphoid bone *s* protrudes abnormally and that the line *e-f* is not in the perpendicular as in *c-d* in the normal foot.

It is noticeable that when the arch rolls down the os calcis leans inward. Parent and child both understand from this why placing a wedge under the inner border of this bone, the so-called "foundation of the arch," will raise the whole arch, and thus let the "keystone" bone slip back into its normal position. By this means, too, all pressure is removed from the arch itself, thus giving the bones and ligaments complete rest from strain. Apparently Vesalius understood this mechanism centuries ago, when he used the inverted pig trough for children to walk on as a corrective measure. Since then the ridge-board idea has spread from Italy over the entire world.

COMMENT

Although a perfect form may occasionally come by chance, heredity, nutrition and training in posture are etiologic factors of immense importance. Lloyd George is reported to have said during the war that "England cannot expect an A I army from a C III population." One may well say that people cannot be expected to have A I sons and daughters unless one gives them some conception of what constitutes A I physiques. Although the standards for physical fitness in our army and navy today are pitifully low, nevertheless about 40 per cent of 6,375 men examined for the Marine Corps at Portland were rejected.[10] Anderson states that flatfoot and other rachitic conditions were responsible for nearly 50 per cent of the rejections. Flat feet are the surest sign of the grade of posture that a child will obtain. If the feet and legs from the knees down are perfect, the whole body is likely to be perfect.

If only 1 per cent of children are capable of receiving a grade of A I for posture, then 99 per cent need instruction which is medically supervised. Much may be done in the schools, especially in the grammar grades, but for the highest degree of success an earlier start is essential. Preventive work should begin with the infant. If at birth the parietal bones are soft, the mastoid fontanelles easily palpable, the lamboidal and sagittal sutures open and the bone edges flexible, inadequate calcification is evident. It is then that corrective measures should be instituted.

The adoption of easily applied standards for posture, the arousal of a 100 per cent interest in posture on the part of the medical profession and the stimulation among teachers and lay organizations of greater interest in prevention and correction of incorrect posture are eminently desirable. But these are of mediocre value unless followed up by the physician who can give instruction regarding mineral metabolism, dietary balance and normal health habits. What boots it if by certain exercises or by special devices the physician gets the scaphoid bone back in place so as to correct a flatfoot if he does not at the same time increase the calcification of that bone and its abutting fellows so as to enable them to hold their places permanently? I grant that severe physical deformities are orthopedic problems. But are not the mild cases and those in the initial stages of an insidious onset primarily pediatric?

SUMMARY

1. Proper posture signifies physical perfection, the importance of which challenges the interest of both physicians and laymen.

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10. Anderson, Walter M.: Physical Unfitness, Northwest Med. **25**:28 (Jan.) 1926.

2. The charts for profile posture now in common use are valuable standards. Large charts with forms in outline are readily comprehended even by children.

3. Standards for anterior posture comparable and complementary to the profile forms are suggested which permit anteroposterior grading.

4. The application of both these profile and anterior standards to several hundred children indicates that a person deserving an A I grade is at present extremely rare.

5. Grading and correction of posture should be combined with careful attention to mineral metabolism.

833 Southwest Eleventh Avenue.

DISCUSSION

DR. M. L. BRIDGEMAN, Portland, Ore.: Army training is valuable in improving posture; even in one week it has accomplished a great deal. When the parents cooperate much benefit may be derived.

DR. D. M. DAYTON, Tacoma, Wash.: Postural education is an important part of the work of the pediatricians, and they are often accused by the orthopedists of neglecting it. Factors influencing posture are rickets, bad nutrition and fatigue, and in from 75 to 80 per cent of the cases bad posture may be improved. Many of the patients have a tendency to drop from sight after infancy, at which time the bad posture probably develops. Schools will eventually teach posture adequately, but at the present time it is largely the responsibility of the pediatricians.

DR. W. F. PATRICK, Portland, Ore.: Certain American habits are partially responsible for bad posture. Many muscle groups remain relaxed and unused. Exercise well supervised and directed would overcome this. Pride is a potent factor in obtaining improvement in children. Competitive games are good.

DR. H. S. MOON, Seattle: Growth continues throughout the year; it is not seasonal. Standing against the wall with the feet about an inch away from the wall is a valuable method of teaching proper posture.

DR. J. D. GRIFFITH, Vancouver, B. C.: Considerable importance is attached to breathing exercises, the value of which is recognized by all military experts.

DR. N. W. CLEIN, Seattle: What is the proper sleeping position for infants?

DR. A. E. WADE, Seattle: Education of the parents as to the importance of posture must come from the pediatrician, not from the orthopedist.

DR. C. U. MOORE, Portland, Ore.: The discussion aroused by this posture study is gratifying. As we think it through together progress will be made.

What the proper sleeping position of an infant should be I am unable to state. Mothers who pay no attention to sleeping posture have infants with perfectly straight backs during the creeping stage when exercise has strengthened the muscles and weight bearing has not yet begun.

Copies of these posture charts can be obtained from Miss Clarissa Ashworth, University of Oregon Medical School, Portland, at the very nominal price of $10 for a set of two, painted by hand on window-shade material 3 feet square. This is half the amount commonly charged. These charts roll up easily for transportation. Smaller sizes may be obtained if desired.

RELATION OF INGESTION OF MILK TO CALCIUM METABOLISM IN CHILDREN

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ELIZABETH KNOTT, M.S.
GLADYS EVERSON, M.S.
AND
OLIVE WRIGHT, M.S.
IOWA CITY

The dictum "a quart of milk a day for every child" is largely the result of an investigation by Sherman and Hawley [1] in which it was shown that the optimum amount of calcium is retained only when approximately 1 quart of milk is included in the diet. Calcium from other sources was found to be less available, lower amounts being retained when the calcium was supplied more largely from vegetables and fruits. The variations in the retentions of calcium of children who were living under comparable conditions as well as the results reported in more recent studies with both children and adults [2] suggest that the difference in the amounts of calcium retained may be due in part to the lack of uniformity in the physiologic condition of the persons studied. For example, the potentialities of growth in children or the physiologic balance in adults may have been less well satisfied in some than in others as a consequence of previous regimens in which less than the optimum amounts of certain food essentials were taken. The conditions of the investigations also have varied in regard to the amount of vitamin D in the diet and the amount of sunshine to which the subjects of the tests were exposed. In 1922, when the studies by Sherman and Hawley were made, the relation of vitamin D to the calcium metabolism was not known, although there was some evidence that children grew better during the summer than during the winter

From the Iowa Child Welfare Research Station, State University of Iowa.
A preliminary report was given at the February meeting of the Society for Experimental Biology and Medicine, Iowa branch, Feb. 23, 1933.

1. Sherman, H. C., and Hawley, E.: J. Biol. Chem. **53**:375, 1922.

2. Willard, A. C., and Blunt, K.: J. Biol. Chem. **75**:251, 1927. Hart, M. C.; Tourtellotte, D., and Heyl, F. W.: J. Biol. Chem. **76**:143, 1928. Wang, C. C.; Kaucher, M., and Frank, M.: Metabolism of Undernourished Children; Calcium Metabolism, Am. J. Dis. Child. **35**:856 (May) 1928. Kramer, M. M.; Latzke, E., and Shaw, M. M.: J. Biol. Chem. **79**:283, 1928.

months. Appreciating this, Sherman and Hawley made some of their tests in August and September. The findings, however, approximated those of the winter months.

With infants the addition of vitamin D, in cod liver oil or viosterol, or by exposure to the ultraviolet rays of the sun or of a mercury quartz lamp, results in marked increases in the amount of calcium and phosphorus retained.[3] In older children, although there is less evidence, similar phenomena occur. In children suffering from late rickets the addition of vitamin D produces increased retention of calcium and normal calcification.[4] It seems probable, therefore, that if more calcium is retained when vitamin D is given, less calcium may be needed, and thus the amount of milk required in any given diet may be less than a quart; perhaps the amount may be more nearly proportional to the size of the person. For example, a child aged 3 years may obtain sufficient calcium from 1 pint of milk, furnishing about one third of his food requirements, whereas a child of 12 years may need a quart. Indeed, Sherman and Hawley's results suggest that such may be the case. The retention of a child aged 12 years and 9 months during high ingestions of calcium averaged 0.82 Gm. per day, whereas the highest retention among children aged 4 and 5 years at similar high levels of ingestion of calcium was 0.312 Gm. If 1 quart of milk will give such high retention in a child aged 12 years, it seems probable that 1 pint may supply enough calcium for a child needing considerably less than one-half this amount.

In the present study the influence which variations in the amount of milk ingested (1 pint and 1 quart respectively) have on the retentions of calcium, phosphorus and nitrogen has been determined in children of a given group receiving, so far as possible, comparable amounts of vitamin D. Since we desired to determine, if possible, the optimum amount of calcium which children of the ages studied should retain, the conditions of the investigation differed from those of others in that the same children were studied during several dietary regimens in which not only the amounts of milk ingested varied, but the amounts of vitamin D as well.

EXPERIMENTAL DATA

The children, two girls and eight boys, were between 3 and 5 years of age. With the exception of two who were slightly underweight, the children were quite normal, conforming to the accepted standards of weight for height. Roentgenograms showed no abnormalities of bone development. Six of the children had lived

3. Daniels, A. L.; Stearns, G., and Hutton, Mary K.: Calcium Metabolism in Artificially Fed Infants; Influence of Cod Liver Oil and Irradiated Milk, Am. J. Dis. Child. **37**:296 (Feb.) 1929.

4. Stearns, G.; Oelke, M. J., and Boyd, J. D.: Mineral Metabolism in Late Rickets, Am. J. Dis. Child. **42**:88 (July) 1931.

for a year or more in a state orphanage; three were from a county juvenile home. Two of the latter were returned to their home and again studied. One child came from a private home in which the dietary conditions were good. The diets of the two children's homes had included a quart of milk per day per child. In the county home, however, the ingestion of food was more carefully supervised, and therefore considerably more of one kind of food and less of another could not be taken. The children from the county home also were given during the winter months 1 dessert-spoonful of cod liver oil daily. In the state orphanage there was more freedom of choice of the foods served. The child from the private home was pink and sturdy, quite above the average in weight and physical well-being.

The general plan of the study consisted in giving standard weighed diets, differing chiefly in the amount of milk and vitamin D. When a pint of milk was used, the protein, phosphorus and fat moiety of the diet was made comparable to that of the period in which a quart was used, by increasing the amount of egg, meat and butter. With the exception of a change from carrots to beans in the spring, the diets consisted of the same foods during each metabolic period. We began the study believing that 40 calories per pound of body weight would meet the metabolic needs and allow for normal activity and growth, but during the first metabolic period the two children under observation lost weight slightly; thereafter from 43 to 46 calories per pound were given. The amount of protein in the diets was probably generous, from 1.1 to 1.6 Gm. per pound of body weight, but since little is known regarding the amount of protein needed by children of these ages, it seemed best to give what would seem to be liberal amounts. With the exception of the orange juice and cod liver oil, which were given twice daily between meals, the food was divided evenly among the three meals, one third of the protein, fat and carbohydrate being given at each meal.

During the investigation the children were given as much sunshine and cod liver oil as seemed consistent with normal living, and in order that we might compare the influence of vitamin D on the retentions of calcium when the children were receiving 1 pint and 1 quart of milk respectively, so far as possible, the children were kept under identical conditions. Those in a given group slept, played and ate at the same time and under the same conditions. The period spent outdoors also was the same for any given group. During the winter months there was less outdoor play than is desirable; therefore the two south windows of the room in which the children played were equipped with corex glass panes (3 by 1½ feet [91 by 45 cm.]), which were cleaned daily. All the children with the exception of the four studied in June and July were given daily 2 teaspoonfuls of cod liver oil. With these four exceptions, the children also received a ten minute exposure (five minutes anterior and five minutes posterior) to ultraviolet rays from a mercury quartz lamp.[5] During certain periods, in order to obtain information regarding the optimum retentions of calcium when 1 pint and 1 quart of milk respectively were taken, 4 drops of viosterol were added to each teaspoonful of cod liver oil.

Studies of calcium balance were made also during the latter part of June and July with four children receiving 1 pint and 1 quart of milk respectively. These studies differed from the others in that no cod liver oil, ultraviolet irradiation or viosterol was given. The children spent the greater part of the day outdoors in the sunshine, their clothing consisting of a one-piece, short-sleeved, knee-length

5. Mazda type S-1 sun lamp which had previously been tested for its antirachitic potency with rachitic rats.

TABLE 1.—*Daily Diets of Children During Period of Low Intake of Calcium* *

Name	Date	Weight, Kg.	Bread (W. W.†), Gm.	Oatmeal, Gm.	Prunes, Gm.	Sugar, Gm.	Butter, Gm.	Potatoes, Gm.	Beef, Gm.	Apple Sauce, Gm.	Tomatoes, Gm.	Egg, Gm.	Bananas, Gm.	Carrots, Gm.	Orange Juice, Cc.	Total Calories	Protein, Gm.
Period I. Average Daily Ingestion of Food. Milk (475 Cc.); Cod Liver Oil																	
D. P.	2/13-18	14.4	45	12.6	50	12	15	100	36	75	110	50	60	60	120	1,329	43.2
C. P.	2/13-18	16.2	55	12.6	50	16	23	100	36	75	110	50	60	60	120	1,432	44.0
B. S.	2/26-3/2	12.9	30	12.6	50	12	17	75	36	75	83	50	60	40‡	120	1,262	40.7
L. T.	3/10-15	13.7	30	12.6	50	12	16	75	36	75	83	50	60	40	120	1,264	40.6
G. O.	3/10-15	15.7	55	12.6	50	16	25	100	36	75	110	50	60	60	120	1,446	44.0
R. H.	5/13-18	17.1	65	12.6	60	19	26	100	45	80	110	70	70	60	120	1,579	49.9
B. Mc.	5/13-18	18.8	75	12.6	75	26	28	120	50	90	110	75	90	70	120	1,758	53.8
F. W.	6/ 4-9	14.1	45	12.6	50	12	16	100	36	75	110	50	60	60‡	120	1,335	43.7
B. V.	9/25-30	17.8	65	12.6	60	26	28	100	50	90	110	75	90	70	120	1,672	52.0
D. P.	9/25-30	15.0	55	12.6	50	18	22	100	20	75	110	30	60	60	120	1,377	38.0
C. P.	9/25-30	16.6	70	12.6	60	21	29	100	20	80	110	40	70	60	120	1,540	41.1
Period II. Average Daily Ingestion of Food. Milk (475 Cc.); Cod Liver Oil; Viosterol																	
F. W.	4/14-19	14.1	45	12.6	50	12	16	100	42	75	110	50	60	60	120	1,346	44.5
R. H.	4/14-19	16.5	60	12.6	60	20	26	100	45	80	110	70	60	60	120	1,561	49.3
D. P.	5/1-6	15.4	55	12.6	50	18	22	100	20	75	110	30	60	60	120	1,377	37.9
C. P.	5/1-6	17.0	70	12.6	60	21	29	100	20	80	110	40	70	60	120	1,540	41.1
G. O.	5/13-18	16.1	60	12.6	50	20	27	100	36	80	110	50	70	60	120	1,505	44.6
L. T.	6/4-9	14.3	45	12.6	50	14	18	75	42	75	83	70	60	50‡	120	1,366	46.6
B. Mc.	6/4-9	19.7	75	20.0	80	26	28	100	50	95	110	85	95	80	120	1,838	57.8
D. P.	10/3-8	15.1	55	12.6	50	18	22	100	20	75	110	30	60	60	120	1,377	38.0
C. P.	10/3-8	16.1	70	12.6	60	21	29	100	20	80	110	40	70	60	120	1,540	41.1
B. V.	10/3-8	18.3	65	12.6	60	26	28	100	50	90	110	75	90	70	120	1,672	52.0
Period III. Average Daily Ingestion of Food. Milk (475 Cc.); Wesson Oil §																	
B. Mc.	7/9-14	18.9	75	20.0	80	26	28	130	50	95	110	85	95	80‡	120	1,838	57.8
R. H.	7/9-14	17.0	65	12.6	60	19	26	100	45	80	110	70	70	50‡	120	1,574	50.4
F. W.	7/9-14	14.0	45	12.6	50	12	16	100	36	75	110	50	60	60‡	120	1,335	43.8

* Caloric ingestions and protein of diet were estimated from published data (Rose, M. S.: Laboratory Handbook for Dietetics, ed. 3, New York, The Macmillan Company, 1929).

† Whole wheat.

‡ Green beans substituted for carrots.

§ During June and July 10 cc. of Wesson oil was substituted for cod liver oil.

TABLE 2.—*Daily Diets of Children During Period of High Intake of Calcium* *

Name	Date	Weight, Kg.	Bread (W. W.†), Gm.	Oatmeal, Gm.	Prunes, Gm.	Sugar, Gm.	Butter, Gm.	Potatoes, Gm.	Beef, Gm.	Apple Sauce, Gm.	Tomatoes, Gm.	Egg, Gm.	Bananas, Gm.	Carrots, Gm.	Orange Juice, Cc.	Total Calories	Protein, Gm.
Period IV. Average Daily Ingestion of Food. Milk (950 Cc.); Cod Liver Oil																	
G. O.	3/18-23	16.2	30	12.6	30	14	14	75	15	50	83	40	40	40	100	1,433	50.0
L. T.	3/18-23	14.0	30	12.6	30	10	10	60	15	40	70	40	40	40	100	1,361	49.6
B. Mc.	5/21-26	19.3	60	12.6	60	22	19	110	15	80	110	30	80	50‡	100	1,761	54.6
R. H.	5/21-26	17.4	50	12.6	50	18	17	60	12	80	110	20	70	40‡	100	1,600	50.0
F. W.	6/12-17	14.4	26	10.0	30	13	9	60	10	50	60	20	55	40‡	120	1,337	45.6
D. P.	6/24-29	14.9	20	10.0	40	17	12	60	10	70	60	20	60	40	120	1,419	44.8
C. P.	6/24-29	16.4	20	12.6	40	20	18	60	10	90	60	20	70	60	120	1,526	45.6
B. V.	10/14-19	18.5	65	15.1	60	23	20	110	15	90	110	45	90	50	120	1,847	57.2
D. P.	10/14-19	15.3	20	15.1	40	17	12	72	15	80	60	25	60	40	120	1,473	47.7
C. P.	10/14-19	17.0	20	15.1	40	20	18	72	15	100	60	30	70	60	120	1,579	48.8
Period V. Average Daily Ingestion of Food. Milk (950 Cc.); Cod Liver Oil; Viosterol																	
D. P.	4/1-6	14.9	30	12.6	30	10	11	60	20	40	70	40	40	40	100	1,377	50.6
C. P.	4/1-6	16.4	30	12.6	30	14	16	80	25	60	83	50	50	40	100	1,504	53.7
G. O.	5/21-26	16.4	30	12.6	40	16	17	60	12	70	110	20	70	40‡	100	1,502	47.8
L. T.	6/12-17	14.5	30	12.6	30	22	19	60	10	40	83	25	40	50‡	120	1,463	47.3
B. Mc.	6/12-17	19.6	65	12.6	60	23	20	110	15	90	110	45	90	50‡	120	1,836	57.3
B. V.	10/23-28	18.7	45	15.1	60	21	18	100	15	90	100	45	90	50	120	1,764	54.9
D. P.	10/23-28	15.4	20	15.1	40	17	12	72	15	80	60	25	60	40	120	1,473	47.7
C. P.	10/23-28	17.5	20	15.1	40	20	18	72	15	100	60	30	70	60	120	1,578	48.8
Period VI. Average Daily Ingestion of Food. Milk (950 Cc.); Wesson Oil §																	
E. E.	6/24-29	21.2	75	12.6	80	26	24	130	25	100	110	50	100	80	120	1,975	61.8
B. Mc.	7/17-22	19.1	65	12.6	60	23	20	110	15	90	110	45	90	50‡	120	1,836	57.3
R. H.	7/17-22	17.4	50	12.6	50	18	17	60	12	80	110	20	70	40‡	100	1,600	50.0
F. W.	7/17-22	14.4	26	10.0	30	13	9	60	10	50	60	20	55	40‡	120	1,337	45.6

* Caloric ingestions and protein of diet were estimated from published data (Rose, M. S.: Laboratory Handbook for Dietetics, ed. 3, New York, The Macmillan Company, 1929).

† Whole wheat.

‡ Green beans substituted for carrots.

§ During June and July 10 cc. of Wesson oil was substituted for cod liver oil.

garment. They wore neither shoes, stockings nor hats. For one hour in the middle of the day, clad only in bathing suits, they played in the swimming pool which is in the sunny part of the playground.

At all times the children were under the constant supervision of graduate nurses trained in the technic of the metabolism ward. During the early part of the work the group observed consisted of two children; later a third child was added.

With the exception of the milk, which was fresh each day, enough food was purchased to carry through an entire metabolic period. This was kept in an electric refrigerator at low temperature. The vegetables for the entire period were cleaned, cut in cubes and covered with distilled water, each day's supply being cooked separately. Prunes and apples were cooked in quantity for the entire period. All foods were cooked in distilled water, and distilled water only was used for drinking. Each day the milk obtained from a local pasteurizing plant was thoroughly mixed, and 100 cc. was set aside for analysis. These samples were combined, and the analysis made of the composite sample. An aliquot of a day's supply of the other food served each child was mixed with acid alcohol, dried, weighed, pulverized and subsequently analyzed.

Each metabolic period consisted of eight days, a three-day preliminary period and a five-day collection period. Stools, marked with carmine, and urine were collected quantitatively, the latter being collected under toluene and placed on ice immediately. Each twenty-four hour collection of urine was analyzed at once for nitrogen, phosphorus, and creatinine. Aliquots of each day's excretion were pooled, and calcium determinations were made at the end of the period. The stools were mixed immediately with acid alcohol and kept on ice until the end of a twenty-four hour period, when they were combined, dried first on the water bath and then in an electric oven, weighed, pulverized and stored for subsequent analysis.

The question of the accuracy of the data always presents itself in any study of this kind. Appreciating that there are many places in which errors may occur, we have tried in every way possible to avoid them. The nurses in charge of the children were trained women, splendidly cooperative, who appreciated the importance of their part in the project. Careful records were kept of all the food served. With one exception, all food served was eaten readily. The length of the metabolism periods and the method of marking off the stools would seem to preclude any gross errors in fecal collections. Urine bottles were labeled at the time of each voiding with the name, date and hour. These data also were recorded in the permanent records, and checks made when the collections of urine were pooled. The constancy of the daily urinary nitrogen, phosphorus and creatinine further gave assurance that there were no losses.

Determinations of nitrogen were made by means of the Kjeldahl method and those of phosphorus by the method of Fiske and Subbarow.[6] Dry samples of food and feces were ashed in an electric muffle furnace, and the gravimetric method of McCrudden was used for the determination of calcium in these and in the urines. Results which seemed unusually high or low were checked by Shohl's[7] modification of the McCrudden method. Later certain high figures were again checked by the method of Washburn and Shear.[8] Questionable urines also were checked by the

6. Fiske, C. H., and Subbarow, Y.: J. Biol. Chem. **66**:375, 1925.
7. Shohl, A. T.: J. Biol. Chem. **50**:527, 1922.
8. Washburn, M. L., and Shear, M. J.: J. Biol. Chem. **99**:21, 1932.

TABLE 3.—*Retention of Calcium, Phosphorus and Nitrogen During Period of Low Intake of Calcium*

Name	Dates	Weight, Kg.	Age Yr.	Age Mo.	Calcium Intake, Gm.	Calcium Excretion Urine, Gm.	Calcium Excretion Feces, Gm.	Calcium Retention Total, Gm.	Calcium Retention Per Kg., Gm.	Phosphorus Intake, Gm.	Phosphorus Excretion Urine, Gm.	Phosphorus Excretion Feces, Gm.	Phosphorus Retention Total, Gm.	Phosphorus Retention Per Kg., Gm.	Nitrogen Intake, Gm.	Nitrogen Excretion Urine, Gm.	Nitrogen Excretion Feces, Gm.	Nitrogen Retention Total, Gm.	Nitrogen Retention Per Kg., Gm.
Period I. Retention of Calcium, Phosphorus and Nitrogen in Children Receiving Milk (475 Cc.) and Cod Liver Oil																			
D. P.	2/13-18	14.4	3	7	0.775	0.070	0.567	0.138	0.010	0.906	0.501	0.322	0.083	0.006	6.910	5.230	0.804	0.871	0.061
C. P.	2/13-18	16.2	4	9	0.783	0.061	0.569	0.153	0.010	0.924	0.508	0.279	0.137	0.009	7.104	4.968	0.894	1.242	0.077
B. S.	2/26-3/2	12.9	3	0	0.752	0.027	0.553	0.172	0.013	0.887	0.411	0.325	0.151	0.012	6.761	4.354	1.026	1.381	0.107
L. T.	3/10-15	13.7	3	10	0.771	0.024	0.526	0.221	0.016	0.929	0.422	0.325	0.182	0.013	6.857	4.772	0.611	1.474	0.108
G. O.	3/10-15	15.7	4	11	0.848	0.054	0.640	0.154	0.010	1.007	0.464	0.401	0.142	0.009	7.437	4.773	0.989	1.675	0.106
R. H.	5/13-18	17.1	4	4	0.823	0.054	0.609	0.160	0.009	1.132	0.556	0.380	0.196	0.012	8.610	5.876	1.298	1.436	0.084
B. Mc.	5/13-18	18.8	5	2	0.833	0.053	0.718	0.061	0.003	1.186	0.558	0.475	0.153	0.008	9.162	5.396	1.560	2.206	0.117
F. W.	6/4-9	14.1	3	1	0.795	0.209	0.519	0.067	0.005	1.031	0.519	0.367	0.145	0.010	7.895	4.789	0.978	2.128	0.152
B. V.	9/25-30	17.8	5	6	0.808	0.030	0.639	0.139	0.008	1.162	0.598	0.463	0.101	0.006	8.962	6.570	1.447	0.945	0.053
D. P.	9/25-30	15.0	4	3	0.784	0.075	0.578	0.131	0.009	0.954	0.481	0.321	0.152	0.010	6.642	4.976	0.957	0.709	0.047
C. P.	9/25-30	16.6	5	5	0.810	0.073	0.484	0.253	0.015	1.028	0.538	0.315	0.175	0.011	7.270	5.242	0.873	1.155	0.069
Average					0.798	0.066	0.582	0.150	0.010	1.013	0.505	0.361	0.147	0.010	7.601	5.177	1.040	1.384	0.089
Period II. Retention of Calcium, Phosphorus and Nitrogen in Children Receiving Milk (475 Cc.), Cod Liver Oil and Viosterol																			
F. W.	4/14-19	14.0	3	0	0.817	0.192	0.403	0.222	0.016	1.005	0.534	0.271	0.200	0.014	7.690	4.935	0.916	1.842	0.131
R. H.	4/14-19	16.5	4	3	0.868	0.062	0.646	0.160	0.010	1.170	0.539	0.401	0.230	0.014	8.840	5.327	1.182	2.331	0.141
D. P.	5/1-6	15.4	3	9	0.802	0.084	0.541	0.177	0.011	0.915	0.473	0.334	0.108	0.006	6.458	4.666	0.764	1.028	0.067
C. P.	5/1-6	17.0	4	12	0.814	0.090	0.583	0.141	0.008	0.990	0.544	0.341	0.105	0.006	7.160	5.092	1.029	1.039	0.061
G. O.	5/13-18	16.0	5	1	0.802	0.077	0.669	0.056	0.004	1.064	0.494	0.434	0.136	0.009	8.130	5.190	0.995	1.945	0.121
L. T.	6/4-9	14.3	4	1	0.804	0.048	0.716	0.040	0.003	1.070	0.466	0.539	0.065	0.005	8.150	5.674	0.938	1.538	0.108
B. Mc.	6/4-9	19.7	5	3	0.876	0.051	0.709	0.116	0.006	1.292	0.662	0.461	0.169	0.009	9.885	6.036	1.556	2.293	0.117
D. P.	10/3-8	15.1	4	3	0.793	0.115	0.543	0.135	0.009	0.932	0.542	0.322	0.068	0.005	6.707	4.872	0.879	0.956	0.062
C. P.	10/3-8	16.7	5	5	0.819	0.109	0.560	0.150	0.009	0.993	0.557	0.328	0.108	0.006	7.351	5.280	1.053	1.018	0.060
B. V.	10/3-8	18.3	5	5	0.815	0.065	0.597	0.153	0.008	1.121	0.621	0.378	0.122	0.006	8.658	6.340	1.199	1.119	0.060
Average					0.821	0.089	0.597	0.135	0.008	1.055	0.543	0.381	0.131	0.008	7.903	5.341	1.051	1.511	0.093
Period III. Retention of Calcium, Phosphorus and Nitrogen in Children Receiving Milk (475 Cc.)																			
B. Mc.	7/9-14	18.9	5	4	0.845	0.027	0.748	0.070	0.004	1.292	0.530	0.627	0.135	0.007	9.662	6.450	1.555	1.657	0.087
R. H.	7/9-14	17.0	4	6	0.812	0.041	0.645	0.126	0.007	1.172	0.517	0.416	0.239	0.014	8.582	5.499	1.353	1.730	0.102
F. W.	7/9-14	14.0	3	2	0.777	0.156	0.496	0.125	0.009	1.044	0.525	0.343	0.176	0.013	7.380	4.854	1.157	1.369	0.098
Average					0.811	0.075	0.630	0.107	0.007	1.169	0.524	0.462	0.183	0.011	8.541	5.601	1.355	1.585	0.095

TABLE 4.—*Retention of Calcium, Phosphorus and Nitrogen During Period of High Intake of Calcium*

Name	Dates	Weight, Kg.	Age Yr.	Age Mo.	Calcium Intake, Gm.	Calcium Excretion Urine, Gm.	Calcium Excretion Feces, Gm.	Calcium Retention Total, Gm.	Calcium Retention Per Kg., Gm.	Phosphorus Intake, Gm.	Phosphorus Excretion Urine, Gm.	Phosphorus Excretion Feces, Gm.	Phosphorus Retention Total, Gm.	Phosphorus Retention Per Kg., Gm.	Nitrogen Intake, Gm.	Nitrogen Excretion Urine, Gm.	Nitrogen Excretion Feces, Gm.	Nitrogen Retention Total, Gm.	Nitrogen Retention Per Kg., Gm.
Period IV. Retention of Calcium, Phosphorus and Nitrogen in Children Receiving Milk (950 Cc.) and Cod Liver Oil																			
G. O.	3/18-23	16.2	4	11	1.341	0.099	1.143	0.098	0.006	1.292	0.550	0.609	0.133	0.008	8.088	5.972	0.697	1.419	0.087
L. T.	3/18-23	14.0	3	10	1.341	0.040	1.128	0.173	0.012	1.280	0.552	0.578	0.150	0.011	7.970	6.260	0.727	0.983	0.070
B. Mc.	5/21-26	19.3	5	2	1.397	0.077	1.171	0.149	0.008	1.408	0.655	0.580	0.173	0.009	9.435	5.970	1.293	2.172	0.113
R. H.	5/21-26	17.4	4	4	1.352	0.065	1.133	0.154	0.009	1.339	0.695	0.514	0.131	0.008	8.702	5.857	1.449	1.396	0.080
F. W.	6/12-17	14.4	3	1	1.312	0.206	0.923	0.183	0.013	1.256	0.643	0.466	0.147	0.010	7.766	5.306	0.974	1.486	0.103
D. P.	6/24-29	14.9	3	11	1.309	0.104	1.072	0.133	0.009	1.180	0.611	0.494	0.075	0.005	7.287	5.592	0.826	0.869	0.058
C. P.	6/24-29	16.4	5	1	1.326	0.091	1.041	0.194	0.012	1.234	0.686	0.412	0.136	0.008	7.588	5.629	0.857	1.102	0.067
B. V.	10/14-19	18.5	5	1	1.402	0.069	1.150	0.184	0.010	1.433	0.735	0.591	0.107	0.006	9.286	6.733	1.656	0.897	0.049
D. P.	10/14-19	15.3	4	3	1.323	0.120	1.025	0.178	0.011	1.255	0.673	0.489	0.095	0.006	7.876	6.188	0.940	0.748	0.050
C. P.	10/14-19	17.0	5	5	1.329	0.114	1.032	0.183	0.011	1.278	0.764	0.411	0.103	0.006	8.058	6.419	0.990	0.649	0.038
Average					1.343	0.098	1.082	0.163	0.010	1.295	0.656	0.514	0.125	0.008	8.206	5.993	1.041	1.172	0.071
Period V. Retention of Calcium, Phosphorus and Nitrogen in Children Receiving Milk (950 Cc.), Cod Liver Oil and Viosterol																			
D. P.	4/1-6	14.9	3	8	1.317	0.094	1.072	0.151	0.010	1.269	0.629	0.501	0.139	0.009	8.368	5.750	0.886	1.732	0.116
C. P.	4/1-6	16.4	4	11	1.326	0.104	1.114	0.108	0.007	1.309	0.724	0.480	0.105	0.006	8.910	6.380	0.918	1.612	0.098
G. O.	5/21-26	16.4	5	1	1.331	0.100	1.137	0.094	0.006	1.299	0.649	0.552	0.098	0.006	8.167	6.021	1.007	1.139	0.069
L. T.	6/12-17	14.5	4	1	1.324	0.062	1.220	0.042	0.003	1.287	0.564	0.666	0.057	0.004	7.806	6.056	0.896	0.854	0.059
B. Mc.	6/12-17	19.6	5	3	1.389	0.073	1.142	0.174	0.009	1.503	0.785	0.564	0.154	0.008	9.631	6.590	1.372	1.669	0.085
B. V.	10/23-28	18.7	5	2	1.417	0.049	1.193	0.175	0.009	1.399	0.751	0.522	0.126	0.007	9.145	6.588	1.316	1.241	0.066
D. P.	10/23-28	15.4	4	4	1.362	0.095	1.153	0.114	0.008	1.259	0.690	0.485	0.084	0.005	7.894	5.816	1.254	0.824	0.054
C. P.	10/23-28	17.5	5	5	1.370	0.113	1.038	0.219	0.011	1.274	0.754	0.410	0.110	0.006	8.059	6.567	0.899	0.593	0.034
Average					1.355	0.086	1.134	0.135	0.008	1.325	0.693	0.523	0.109	0.006	8.498	6.221	1.069	1.208	0.073
Period VI. Retention of Calcium, Phosphorus and Nitrogen in Children Receiving Milk (950 Cc.)																			
E. E.	6/24-29	21.2	5	6	1.418	0.063	1.245	0.110	0.005	1.496	0.776	0.562	0.158	0.007	10.032	6.739	1.291	2.002	0.094
B. Mc.	7/17-22	19.1	5	4	1.423	0.037	1.351	0.035	0.002	1.549	0.674	0.796	0.079	0.004	10.000	6.795	1.451	1.754	0.092
R. H.	7/17-22	17.4	4	6	1.382	0.044	1.197	0.141	0.008	1.407	0.625	0.584	0.198	0.011	8.692	5.414	1.506	1.772	0.102
F. W.	7/17-22	14.4	3	2	1.326	0.182	0.876	0.268	0.018	1.241	0.661	0.375	0.205	0.014	7.770	5.198	1.033	1.539	0.106
Average					1.387	0.082	1.167	0.138	0.008	1.423	0.684	0.579	0.160	0.009	9.124	6.037	1.320	1.767	0.099

method of Shohl and Pedley.[9] In all cases amounts of calcium determined by gravimetric procedures were within the limits of experimental error. Calcium determinations by volumetric methods yielded slightly lower values, from 2 to 5 per cent. All determinations were in triplicate.

RESULTS

The amount of calcium retained by the children studied during the two periods in which cod liver oil was given, when they were receiving a pint and a quart of milk respectively, suggests that 1 pint of milk, when used as a part of diets which are believed to be optimum in other respects, furnishes sufficient calcium for the physiologic needs of children between 3 and 5 years of age, provided the calcium is available. An average of 0.010 Gm. per kilogram of body weight was retained by the children who were receiving 1 pint and 1 quart respectively when cod liver oil only was given (tables 3 and 4, periods I and IV). When viosterol was added to the cod liver oil, although slightly less calcium was retained, the average (0.008 Gm. per kilogram) was the same for both periods (tables 3 and 4, periods II and V). During the periods of exposure to sunshine, when neither cod liver oil nor viosterol was given, the average retentions differed only slightly from those of the other periods: 0.008 Gm. per kilogram for the period in which the children received a quart, and 0.007 Gm. for that in which they received a pint of milk (tables 3 and 4, periods III and VI).

The average amount of phosphorus retained in all groups was found to be higher during the period in which a pint of milk was given, even though the ingestions were somewhat lower. The largest retentions were found during the periods of exposure to sunshine (0.011 Gm. per kilogram) when the children were receiving a pint of milk, and the lowest (0.006 Gm. per kilogram) during the period in which they received a quart of milk and viosterol. The addition of viosterol in the amounts given apparently had little influence on the retention of phosphorus in the children studied.

Although the retentions of nitrogen in a given subject may not be directly related to the retentions of calcium, we are including these, for they seem to be significant in the interpretations of the data on calcium and phosphorus. It will be noted that the average ingestions of nitrogen of the children during the two periods of varying intake of milk were slightly higher when the children were receiving the quart of milk. Yet, with the exception of the periods of exposure to sunshine, more nitrogen was retained during the period of lower ingestions, when the pint of milk was being taken, the average for the period in which cod liver oil and a pint of milk were taken being 0.089 Gm. per kilogram, and for the period when viosterol was added, 0.093 Gm. per

9. Shohl, A. T., and Pedley, F. G.: J. Biol. Chem. **50**:537, 1922.

kilogram (table 3, periods I and II). During the period in which a quart of milk and 2 teaspoonfuls of cod liver oil were given the average retention was 0.071 Gm. per kilogram. When viosterol was added, the retention averaged 0.073 Gm. per kilogram (table 4, periods IV and V). During the two periods of exposure to sunshine the average retentions were similar: 0.095 Gm. per kilogram during the period in which a pint of milk was taken and 0.099 Gm. per kilogram during the time in which a quart, was used.

COMMENT

Our results, studied from the standpoint of averages, are not in line with present theories. It would appear from the data that under certain dietary conditions 1 pint of milk will supply enough calcium to meet the physiologic needs of children of the ages studied (from 3 to 5 years). A consideration of the conditions of the experiments, however, may be of value in interpreting the results, especially in relation to the data from other laboratories. During the early part of our study, the children came to the metabolism ward for single ten-day periods. Later they remained in the ward for two consecutive periods of nine days each. The diets during the first period contained in general the lower amounts of milk; when the influence of viosterol was being tested, this was given during the second period, or in a few cases when two consecutive periods were being tested the smaller amount of milk also was given during the first period. These precautions were taken in order to avoid the possible influence of the first period on the second. If a child should be depleted in any one of the constituents tested, and the larger amounts of the food containing that substance were given first, the results might seem to indicate that more was retained because of the larger amounts given, whereas enough may have been present to supply the needs in the smaller amount. It was in order to avoid such errors in interpretation that the lower levels of calcium were given first. In all cases three days were allowed for physiologic adjustment to a new dietary regimen before the quantitative collections were begun. The dates of the metabolism periods given in table 5 indicate the single and double periods.

It will be noted that the retentions of calcium in certain of the children are higher during the first metabolism periods even though less milk and therefore less calcium was taken (table 5). When viosterol was given during two consecutive periods, the retentions of calcium were in some cases higher during the second period with the higher ingestion of milk but no higher than when less milk was given with cod liver oil and viosterol. In other cases the retentions were the same, irrespective of the amount of calcium ingested.

Retentions of phosphorus also were often considerably higher during the first periods, especially among the children from the state orphanage.

R. H., for example, retained 0.012 Gm. and 0.008 Gm. per kilogram, respectively, during two successive periods, the former amount when receiving a pint of milk and the latter when taking a quart of milk. B. Mc. retained 0.009 Gm. and 0.008 Gm. per kilogram during two

TABLE 5.—*Retention of Calcium, Phosphorus and Nitrogen During Successive Metabolism Periods*

Name	Dates	Diet Modification		Ingestion per Kg.			Retention per Kg.		
		Milk, Cc.	Vitamin D*	Calcium, Gm.	Phosphorus, Gm.	Nitrogen, Gm.	Calcium, Gm.	Phosphorus, Gm.	Nitrogen, Gm.
G. O.†	3/10-15	475	C.L.O.	0.055	0.064	0.48	0.010	0.009	0.106
	3/18-23	950	C.L.O.	0.082	0.079	0.49	0.006	0.008	0.087
	5/13-18	475	C.L.O.; V.	0.050	0.067	0.50	0.004	0.009	0.121
	5/21-26	950	C.L.O.; V.	0.081	0.078	0.49	0.006	0.006	0.069
L. T.†	3/10-15	475	C.L.O.	0.056	0.062	0.51	0.016	0.013	0.108
	3/18-23	950	C.L.O.	0.097	0.091	0.56	0.012	0.011	0.070
	6/4-9	475	C.L.O.; V.	0.056	0.075	0.57	0.003	0.005	0.108
	6/12-17	950	C.L.O.; V.	0.091	0.088	0.53	0.003	0.004	0.059
R. H.†	4/14-19	475	C.L.O.; V.	0.052	0.071	0.53	0.010	0.014	0.141
	5/13-18	475	C.L.O.	0.048	0.066	0.50	0.009	0.012	0.084
	5/21-26	950	C.L.O.	0.077	0.076	0.50	0.009	0.008	0.080
	7/9-14	475	.....	0.047	0.068	0.50	0.007	0.014	0.102
	7/17-22	950	.....	0.079	0.081	0.50	0.008	0.011	0.102
B. Mc.†	5/13-18	475	C.L.O.	0.048	0.062	0.48	0.003	0.008	0.117
	5/21-26	950	C.L.O.	0.072	0.072	0.49	0.008	0.009	0.113
	6/4-9	475	C.L.O.; V.	0.044	0.066	0.50	0.006	0.009	0.117
	6/12-17	950	C.L.O.; V.	0.074	0.076	0.49	0.009	0.008	0.085
	7/9-14	475	.....	0.044	0.068	0.50	0.004	0.007	0.087
	7/17-22	950	.....	0.072	0.081	0.52	0.002	0.004	0.092
F. W.†	4/14-19	475	C.L.O.; V.	0.058	0.071	0.54	0.016	0.014	0.131
	6/4-9	475	C.L.O.	0.056	0.073	0.56	0.005	0.010	0.152
	6/12-17	950	C.L.O.	0.091	0.087	0.53	0.013	0.010	0.103
	7/9-14	475	.....	0.055	0.074	0.53	0.009	0.013	0.098
	7/17-22	950	.....	0.092	0.086	0.53	0.018	0.014	0.107
D. P.‡	9/25-30	475	C.L.O.	0.052	0.063	0.44	0.009	0.010	0.047
	10/3-8	475	C.L.O.; V.	0.052	0.061	0.43	0.009	0.005	0.063
	10/14-19	950	C.L.O.	0.086	0.082	0.53	0.011	0.006	0.050
	10/23-28	950	C.L.O.; V.	0.088	0.081	0.52	0.008	0.005	0.054
C. P.‡	9/25-30	475	C.L.O.	0.054	0.062	0.42	0.015	0.011	0.069
	10/3-8	475	C.L.O.; V.	0.049	0.059	0.42	0.009	0.006	0.060
	10/14-19	950	C.L.O.	0.078	0.075	0.42	0.011	0.006	0.038
	10/23-28	950	C.L.O.; V.	0.077	0.072	0.43	0.011	0.006	0.034
B. V.	9/25-30	475	C.L.O.	0.045	0.064	0.50	0.008	0.006	0.053
	10/3-8	475	C.L.O.; V.	0.044	0.061	0.46	0.008	0.006	0.060
	10/14-19	950	C.L.O.	0.075	0.077	0.50	0.010	0.006	0.049
	10/23-28	950	C.L.O.; V.	0.075	0.071	0.49	0.009	0.007	0.066

* C.L.O. = cod liver oil (2 teaspoonfuls daily); V. = viosterol (4 drops twice daily).
† From state orphanage.
‡ From county children's home.

successive periods, the former amount during a period when he was receiving a pint and viosterol and the latter during a period when a quart and viosterol were fed. L. T. and G. O. quite consistently retained more during the first periods, when the diet contained a pint of milk.

Among the children from the state orphanage retentions of nitrogen were consistently high and frequently higher during the first periods.

D. P. and C. P., brother and sister from the juvenile home where the food habits of the children are carefully watched, and B. V., the outstandingly vigorous, well developed child, showed less wide variation not only in retentions of nitrogen but also in the other constituents studied. The greater constancy in the retentions of these three children may possibly be explained by the fact that they were in a better physical condition. The day by day ingestion of food of these children had been more nearly constant than that of the children from the state home. The consistently high retentions of nitrogen of F. W. as well as of others during first periods suggest that certain of the children previously had not been living under optimum conditions.

F. W., with the exception of the first period during which he received a pint of milk with cod liver oil and viosterol, retained more calcium when taking a quart of milk. Retentions of phosphorus were outstandingly high during all the periods. The muscular development of this child, as indicated by his creatinine-length coefficient, 1.84, was considerably below the average (2.60) of the other children studied. The high retentions of phosphorus and nitrogen during all metabolism periods would seem to indicate that he was building muscle, and only when a large amount of phosphorus was available as when a quart of milk was ingested, or when more vitamin D was given, was there enough to build bone and muscle at the same time. On the other hand, the unusually high urinary calcium in all periods, irrespective of the amount ingested, suggests some abnormal physiologic behavior.

The relation of the retentions of calcium, phosphorus and nitrogen were not found to be constant in any given case, nor were they materially affected by the amount of vitamin D in the experiments. Given enough of the various constituents for growth and given the right conditions for absorption and retention, the child apparently takes from his nutrient environment what he needs for his processes of growth. The amount varies from time to time. A child who has been well fed retains considerably less than a child who has been poorly nourished.

Sherman and Hawley observed that the average daily storage of calcium for the ages under consideration is about 0.01 Gm. per kilogram of body weight, and that of phosphorus, 0.008 Gm. per kilogram. Our retentions for calcium are similar for first periods, 0.01 Gm. per kilogram, but slightly lower, 0.008 Gm. per kilogram, for second periods. Average retentions of phosphorus were found to be slightly higher in some groups than the figures given by Sherman and Hawley and lower in others. However, any conclusions based on averages would seem unwarranted. The wide variations found among different children and in the same children under varying conditions lead us to conclude that the amount of calcium that a given child should retain depends on his physiologic need at the moment.

Our diets have differed from those of the study made by Sherman and Hawley in that they have contained less cereal foods and more fruit, vegetables, eggs, meat and vitamin D. In this respect we have endeavored to make them conform to what is now held to be an optimum diet for the ages under consideration. The ingestions of calcium by our children receiving a pint of milk were between 0.044 and 0.059 Gm. per kilogram and by those receiving a quart, between 0.072 and 0.097 Gm. per kilogram, amounts considerably higher than those given in the diets of Sherman and Hawley with the same amounts of milk. The calcium values of our diets containing a pint were more nearly comparable to theirs at the 750 cc. milk levels. Comparing the retentions of calcium of the three children studied by Sherman and Hawley, who were receiving increasingly larger amounts of milk up to 1,500 cc. and subsequently decreasing amounts, it will be seen that more calcium at the same ingestion level was retained during the taking of the increasingly larger amounts than during the decrease in amounts. On low ingestions of milk one child retained as much calcium as when receiving larger amounts of milk and even more than certain of our children at much higher levels of ingestion of milk and of calcium. Our children, too, had the advantage of more vitamin D. In both studies low retentions of calcium are especially noticeable during second successive metabolism periods at the same levels of ingestion of calcium. Retentions of phosphorus in the studies made by Sherman and Hawley as in those herein reported tended to follow the retentions of calcium, higher retentions being found during first periods at similar levels of ingestion. If the explanation of the higher retentions during first periods by certain of our children is previous depletion, it seems probable that these generally high first periods of Sherman and Hawley's study may also be due to the retention of less than optimum amounts previous to the metabolic study. The retentions of calcium of the group of "vigorous normal children" studied by Wang similarly showed wide variations, the lowest retention being 0.004 Gm. per kilogram, and the highest, 0.012 Gm. per kilogram. In these there appeared to be no relation between the amount ingested and the amount retained; low retentions frequently were found to follow high ingestions. In Wang's study only one metabolism period was reported; there is, therefore, no way of knowing whether the high retentions were due to depletion, a possible spurt in growth or some other as yet unrecognized factor. In the group of children who were from 10 to 15 per cent underweight, there were found to be many high retentions. This is to be expected in consideration of the low weight of the children. Comparing the total retentions of calcium of the various groups, wide variations are found among children of similar ages. The retentions of one child, aged 8 years, in the 10 per cent underweight group are slightly less than those of a child of the same

age, in the vigorous normal group, whereas another's retentions are nearly twice as much.

The amount of calcium that a child retains at any given time would seem to be a measure of his physiologic needs at that particular moment, provided enough is available. Single studies cannot determine how much calcium a child of a given age should retain. Balance studies should be made with the same children over a considerable length of time until one can be reasonably sure that they are physiologically full. It seems probable that diets which seemingly have resulted in low retentions have done so, not necessarily because the diets were too low in the given constituent, but because the child being studied needed less and therefore took from the amount offered only what he needed. This sometimes has been little, sometimes more. From the results herein reported, it seems clear that a pint of milk, when included in a diet which supplies approximately 23 per cent of its calcium from other sources, will supply enough calcium for normal children of the ages studied when a sufficient amount of vitamin D or sunshine is allowed. Whether sufficient calcium will be obtained from diets containing a pint of milk when less calcium is given from other sources remains to be determined. Studies of diets which include lower levels of calcium and protein are now in progress.

SUMMARY

Retentions of calcium, phosphorus and nitrogen have been determined in children receiving diets differing chiefly in the amounts of calcium, which was furnished by 1 pint and 1 quart of milk respectively.

Although wide variation was found to exist in the amounts of these essential constituents retained by different children of approximately the same ages and by the same children under varying conditions of diet and of vitamin D, the results indicate that 1 pint of milk will supply sufficient calcium for the normal child between 3 and 5 years of age, provided the diet furnishes enough protein, phosphorus and vitamins from other sources.

The marked differences in the amounts of the various constituents of growth retained by different children and by the same children under varying conditions appear to be due to the physiologic condition of the children at the time of the study and to their potentialities of growth. Those who had been previously less well nourished retained more of the constituents of growth than did those who had been well fed. Normal children between 3 and 5 years of age, were found to retain from 3 to 10 mg. of calcium, from 6 to 8 mg. of phosphorus and from 34 to 90 mg. of nitrogen per kilogram. It is suggested that the high retentions reported in previous investigations may have been due to the fact that the children under observation were more or less depleted in the substances studied.

DIURESIS PRODUCED BY INJECTION OF DEXTROSE

ITS EFFECT ON NITROGEN BALANCE AND ON METABOLISM OF FIXED ACIDS AND BASES IN NORMAL INFANTS

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Induction of diuresis by the intravenous administration of hypertonic solutions of dextrose is a well recognized therapeutic measure for the relief of many forms of intoxication, especially for the form frequently accompanying infantile diarrhea. The effects on the circulation and the changes in the blood during and immediately following induction of diuresis have been amply studied in normal animals, but reports of prolonged observations following this procedure are not available in the literature.

It was possible to obtain data on two normal infants to whom hypertonic solutions of dextrose had been administered intravenously and to follow the metabolism of fixed acids and bases in these subjects for periods of nine days following the initial diuresis. The main objects of this paper are to present data on:

1. The immediate effect of dextrose diuresis on the body content of fixed acids and bases in normal infants.

2. The time interval necessary for the body to resume its normal composition with respect to these substances.

3. Considerations, in the light of the results obtained in normal infants, as to whether the depletion of fixed bases which occurs in gastrointestinal intoxication might be accentuated by a diuresis induced by dextrose.

Hamilton [1] in 1930, studied the urinary and fecal excretion of chlorides, sodium, potassium, sulphur and nitrogen in two normal infants following the administration of physiologic solution of sodium chloride by hypodermoclysis. He found that the normal electrolyte balance was not reassumed for nearly a week after the injection. The potassium, in particular, showed a retention (indicated by the decreased amount of urinary output) beginning a few days after the injection and persisting for nearly a week.

From the Department of Pediatrics, Cornell University Medical College, and the New York Nursery and Child's Hospital.

1. Hamilton, B.: Data presented before the Eastern Pediatric Research Society, 1930.

EXPERIMENTAL PROCEDURE

Two normal male infants, 7½ and 5½ months old, were placed on constant diets consisting of powdered milk, cane sugar and water. Nothing else was given by mouth except viosterol. After the infants had been on this regimen for four days, collections of the urine and stools were begun and were continued over a fore-period of seventy-two hours. The infants were then given two intravenous injections of 20 per cent dextrose solution, at four hour intervals. Both infants responded with a marked diuresis. Collections of the urine and stools were continued for nine days thereafter. The infants took all feedings well and gained weight throughout the periods of observation. It is regrettable that both infants vomited once, just after the subsidence of the active diuresis. With this exception there was no vomiting, no refusal of food, no loose stools or other untoward symptoms during the control or experimental periods.

The food, stools and urine were quantitatively measured and analyzed in triplicate for nitrogen, chlorides, phosphorus, sodium and potassium. In addition, the calcium content of the food and of the stools was determined. The urine was used directly for all the analyses. The food was used directly as the dry powder for the determination of nitrogen and chlorides. The stools were reduced to a dry powder by being evaporated several times on the steam bath with alcohol and then ground thoroughly with a mortar and pestle. This dry powder was used directly for the determination of chlorides and nitrogen. Before being analyzed for sodium, potassium, calcium and phosphorus, the dry powdered milk and the dry powdered stools were subjected to preliminary ashing in a muffle oven at a temperature of 400 C., and the ash was dissolved in dilute hydrochloric acid.

Nitrogen was determined by the macro-Kjeldahl method,[2] chlorides, by a modification of the Van Slyke method,[3] phosphorus, by the Fiske-Subbarow method.[4] The Butler-Tuthill modification of the Barber-Kolthoff [5] method was used for sodium analysis. Calcium was determined by titration of the calcium oxalate precipitate with potassium permanganate. Potassium was determined by the method of Fiske and Litarczek.[6]

RESULTS

The results of the two observations may be seen in table 1. Diuresis was well marked; the urine output totaled twice the fore-period average in case 1, and two and one-half times the average output in case 2. The

2. Official and Tentative Methods of Analysis of the Association of Official Agricultural Chemists, Compiled by the Committee on Editing Methods of Analysis, ed. 3, 1930, Washington, D. C., Association of Official Agricultural Chemists, 1931, p. 21.

3. Van Slyke, D. D.: The Determination of Chlorides in the Blood and Tissues, J. Biol. Chem. **58**:523, 1923. Eisenman, A. J.: A Note on the Van Slyke Method for the Determination of Chlorides in Blood and Tissue, ibid. **82**: 411, 1929.

4. Fiske, C. H., and Subbarow, Y.: The Colorimetric Determination of Phosphorus, J. Biol. Chem. **66**:375, 1925.

5. Butler, A. M., and Tuthill, E.: An Application of the Uranyl Zinc Acetate Method for Determination of Sodium in Biological Material, J. Biol. Chem. **93**: 171, 1931.

6. Fiske, C. H., and Litarczek, G.: A New Method for Potassium, J. Biol. Chem. **67**:16, 1926.

TABLE 1.—*Observations on Infants in Whom Diuresis Had Been Produced by the Injection of Dextrose*

	Urine								Stool										
Period No.	Length of Period, Hours	Total Volume, Cc.	Average Output per Hour, Cc.	Nitrogen*	Chlorides*	Phosphorus*	Sodium*	Potassium*	Period No.	Length of Period, Hours	Wet Weight per 24 Hours, Gm.	Dry Weight per 24 Hours, Gm.	Water Content per 24 Hours, Cc.	Ash per 24 Hours, Gm.	Nitrogen*	Chlorides*	Phosphorus*	Sodium*	Potassium*	Calcium*
Case 1 †																				
I	71.83	1,412	19.7	364.03	36.98	36.55	18.21	37.71	A	72	92.83	14.65	78.18	3.391	42.27	1.28	21.41	3.00	7.54	63.17
20% dextrose intravenously—170 cc. twice, separated by 4 hour interval; total of 68 Gm. dextrose																				
II	11.78	477	40.5	**156.35**	**21.58**	**15.45**	**17.68**	**13.14**	B	24	92.15	15.30	76.85	2.983	48.09	1.32	18.29	1.23	5.37	59.63
III	12.25	120	9.1	**147.36**	**6.60**	**15.30**	**0.08**	**16.83**												
II and III	24.03	597	....	303.71	28.19	30.75	17.76	29.97	C	48	92.89	16.34	76.56	3.163	49.24	1.42	17.30	2.54	5.57	62.42
IV	24.40	472	19.3	365.46	36.34	41.53	13.43	45.64												
V	23.75	556	23.4	380.37	40.46	38.54	20.92	44.44	D	48	96.80	16.12	80.68	3.208	48.15	1.16	16.97	2.45	5.73	60.08
VI	48.25	990	20.5	385.76	38.30	36.71	22.11	43.08												
VII	47.72	1,045	21.9	390.31	38.01	33.61	18.43	42.45	E	96	95.27	16.99	79.53	3.742	50.40	1.46	23.85	2.65	6.73	78.70
VIII	51.68	1,209	23.4	371.28	38.96	36.53	19.64	39.01												
Case 2 ‡																				
I	72.08	1,440	20.0	318.71	28.83	35.92	18.77	36.67	A	72	48.05	8.07	39.9	1.860	40.64	1.71	18.95	0.81	3.16	54.34
20% dextrose intravenously—130 and 170 cc. separated by 4 hour interval; total of 60 Gm. dextrose																				
II	8.13	417	51.4	**111.04**	**16.33**	**9.38**	**14.88**	**9.14**	B	24	53.65	9.35	44.3	2.133	46.54	1.59	22.41	0.76	4.31	59.96
III	16.13	310	19.8	**176.29**	**7.69**	**17.93**	**4.54**	**19.63**												
II and III	24.26	727	....	287.33	24.02	27.31	19.42	28.77	C	48	62.02	9.03	53.0	2.080	45.02	2.75	20.75	1.84	4.37	55.88
IV	23.00	430	18.7	267.26	22.60	27.61	11.98	32.43												
V	25.38	548	21.6	333.56	30.70	32.95	16.29	41.94	D	48	56.18	8.45	52.7	2.053	39.57	2.45	19.09	1.33	4.20	55.48
VI	47.78	1,168	24.4	334.85	33.06	34.83	23.67	40.04												
VII	48.00	1,027	21.4	307.11	31.62	30.93	20.48	34.17	E	96	42.10	7.14	35.0	1.789	33.76	1.26	18.92	0.61	3.10	50.51
VIII	48.00	1,200	25.0	336.62	31.76	32.76	19.88	39.26												

* All substances expressed in cubic centimeters tenth-normal per kilogram of body weight per twenty-four hours except those figures which are in boldface type and which are expressed as cubic centimeters tenth-normal per kilogram of body weight per number of hours of period.

† Case 1 is that of H. S., an infant aged 7½ months and weighing 7,780 Kg. The intake of water per kilogram of body weight was 141.7 cc.; the number of calories per kilogram of body weight was 111.2; the intake of nitrogen was 481.77 cc.; of chloride, 44.32 cc.; of phosphorus, 74.76 cc.; of sodium, 30.21 cc.; of potassium, 56.90 cc., and of calcium, 90.38 cc.

‡ Case 2 is that of D. K., an infant aged 5½ months and weighing 5,860 Kg. The intake of water per kilogram of body weight was 153.6 cc.; the number of calories per kilogram of body weight was 98.3; the intake of nitrogen was 426.64 cc.; of chloride, 36.36 cc.; of phosphorus, 63.03; of sodium, 23.44 cc.; of potassium, 47.96 cc., and of calcium, 83.65 cc.

urine voided on the day of the intravenous injections was divided into two approximately equal periods in case 1, and into an eight hour and a sixteen hour period in case 2. This division was made for the purpose of comparing the output of the different substances during the period of actual diuresis and during the immediately succeeding period.

Output During the First Twenty-Four Hours.—The outpouring of urine during the diuretic process (period II in table 1) carried with it sodium and chloride ions. These results are in agreement with the findings of Cori [7] and of Keith and Whelan,[8] both of whom studied the effects of dextrose diuresis in dogs. In the period following the subsidence of diuresis (period III in table 1) there was a compensatory retention of these ions, as shown by a marked decrease in their urinary output. This decrease was most marked in the excretion of sodium in case 1 (H. S.); it was practically negligible during this period. It is interesting to note the parallelism which existed between the total volume of urine and the excretion of these ions in the urine, and the marked ability of the body to retain sodium when the output of urine is notably reduced. Keith and Whelan noted this retention of sodium and of chlorides in their dogs with subsidence of diuresis. The results are in accord with expectation, since it is generally conceded that the water exchange of the normal organism occurs at the expense of extracellular body fluids which contain these ions predominantly.

The urinary output of potassium was decreased during the actual diuresis, but only to a slight degree. Keith and Whelan found this to be the rule in their dogs, though the rate of decrease was somewhat variable. During the postdiuretic period the balance was restored by a slightly increased excretion, making the total twenty-four hour output only slightly below the normal output established in the fore-period.

The relative rate of urinary excretion of phosphates remained the same throughout periods II and III. According to the literature, excretion of phosphorus in diuresis varies considerably. Owsiany and Wierzuchowski [9] reported a greatly decreased excretion of phosphate during dextrose diuresis in dogs. Carr [10] found that in normal subjects the rate of urinary phosphorus excreted was little affected by profuse water

7. Cori, K.: Ueber die Wirkung intravenös verabreichter Trauberzucker und Gummi arabicum Lösung auf die Diurese, Wien. klin. Wchnschr. **34**:169, 1921.

8. Keith, N. M., and Whelan, M.: Changes in Body Temperature and Metabolism Accompanying Experimental Marked Diuresis, Am. J. Physiol. **77**: 688, 1926.

9. Owsiany, E., and Wierzuchowski, M.: Assimilation des mono-hexoses injectés par voie intraveineuse: Métabolisme du phosphore et de l'eau, Compt. rend. Soc. de biol. **103**:416, 1930.

10. Carr, A. D.: Effect of Water Diuresis on the Elimination of Certain Urinary Constituents, J. Pharmacol. & Exper. Therap. **18**:221, 1921.

diuresis. From some experiments on water diuresis Havard and Reay [11] concluded that, with a given plasma phosphate, the kidney can maintain a constant rate of phosphate excretion, even when, in order to do so, it has to concentrate or dilute the phosphate.

The excretion of nitrogen in the urine was slightly increased during diuresis as compared with the postdiuretic period. This increased excretion was scarcely perceptible in case 1, but was fairly definite in case 2. Peters and Van Slyke [12] stated that "diuresis tends to sweep non-protein nitrogen from the blood, increasing the urinary nitrogen excretion." This quotation would be an overstatement if it were applied to the rather slight changes in the cases studied.

Taking this twenty-four hour period as a whole (periods II and III in table 1), there is found to be a decreased urinary excretion of all the substances studied, except of sodium. The extent of decrease of the different constituents varies from 10 to 20 per cent below the average for the fore-period. This phenomenon probably does not indicate a retention within the body, since it may readily be explained by the reduced intake due to vomiting which occurred in both cases. The sodium showed a delayed fall in the subsequent twenty-four hours when most of the other substances had already begun to rise. The large output of sodium during diuresis might explain this discrepancy.

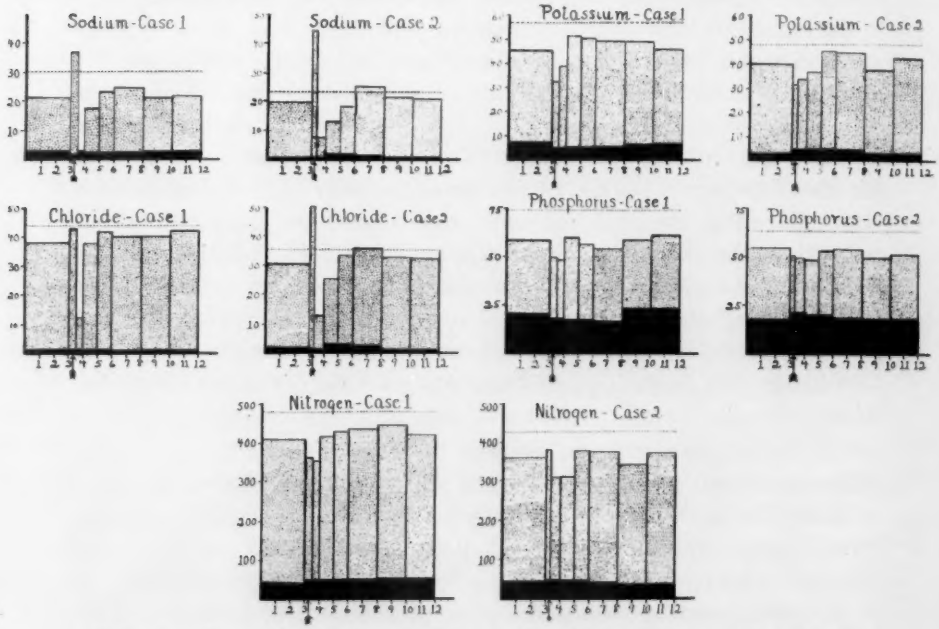
Output During Subsequent Eight Days.—During the eight days following the diuresis, the curves of urinary excretion of the various ions had a remarkable similarity, varying, however, considerably in degree. From one to two days after the initial fall, there was an almost universal tendency for each element to show an increased excretion, gradually returning, in a varying number of days, to approximately the fore-period average. Phosphorus in case 2 was the only exception to this rule. In no instance was this increased output of sufficient magnitude to indicate a significant disturbance of balance. If the increase and subsequent decrease had not occurred in each instance with such regularity, the actual variations in value are not greater than one might find physiologically in any normal infant from day to day. In data to be published from this laboratory,[13] it will be noted that any normal infant on a constant regimen may show daily variations in excretion of these ions which are at least as great as were the maximum variations during the last eight days of observation in the cases studied.

11. Havard, R. E., and Reay, G. A.: Note on the Excretion of Phosphate During Water Diuresis, Biochem. J. **20**:99, 1926.

12. Peters, J. P., and Van Slyke, D. D.: Quantitative Clinical Chemistry, Baltimore, Williams & Wilkins Company, 1931, vol. 1, p. 285.

13. Wheatley, M. A.; Levine, S. Z., and McEachern, T. H.: Personal communication to the author.

This variation was most evident in the case of the potassium excretion, the increase of which was larger and more prolonged than that of most of the other ions. In case 1, the urinary potassium rose to 21 per cent above the fore-period average and did not return to the control level until the last period of observation. In case 2, the rise was only 14 per cent and the return to the normal level occurred at the sixth and seventh day (period VII). Hamilton found a prolonged retention of potassium following subcutaneous injection of saline solution and suggested that apparently the injection of sodium and of chlorides stimulated


Sodium - Case 1
Sodium - Case 2
Potassium - Case 1
Potassium - Case 2
Chloride - Case 1
Chloride - Case 2
Phosphorus - Case 1
Phosphorus - Case 2
Nitrogen - Case 1
Nitrogen - Case 2

Balance of ions studied during entire period of observation. The abscissas indicate the time in days; the ordinates, cubic centimeters, tenth-normal, per kilogram of body weight every twenty-four hours. The black columns indicate fecal excretion; the stippled columns, urinary excretion; the broken line intake, and the arrow, the period of diuresis.

the body to the retention of potassium. Here there was found just the opposite cause and effect—a temporary depletion of sodium and of chlorides during diuresis, followed by a prolonged decreased potassium retention. Gamble, Blackfan and Hamilton [14] found an increased excretion of potassium over a period of six days during which calcium chloride was given daily with 1 liter of water by mouth. They found that the

14. Gamble, J.; Blackfan, K., and Hamilton, B.: Diuretic Action of Acid-Producing Salts, J. Clin. Investigation **1**:359, 1925.

increased output of chloride was chiefly balanced by ammonia, but to some extent also by potassium, in their two normal cases. They believe that the potassium in their cases must have come from within the tissue cells, as it exceeded the total amount normally found in extracellular fluids.

In neither of the cases studied did the child at any time show a negative potassium balance. Even at the point of maximum excretion of potassium there was an appreciable margin between the intake of potassium and the combined urinary and fecal output. This amounted to 5.7 cc. of tenth-normal potassium per kilogram every twenty-four hours in case 1, and to 2.7 cc., in case 2. In figuring this balance, the excretion through the skin has been disregarded but, according to the figures which Swanson and Iob [15] gave for much younger infants, this would be very small, amounting to approximately 0.3 cc. of tenth-normal

TABLE 2.—*Urinary Excretions of Various Ions in Fore-Period as Compared with Average for Nine Days Subsequent to Diuresis* *

	Case 1		Case 2	
	Average for Fore-Period	Average for Subsequent 9 Days	Average for Fore-Period	Average for Subsequent 9 Days
Nitrogen	364.03	366.15	318.71	311.12
Chloride	36.98	36.71	28.83	28.96
Phosphorus	36.55	36.29	35.92	31.06
Sodium	18.21	18.71	18.77	18.62
Potassium	37.71	40.76	36.67	36.10

* All values expressed as cubic centimeters, tenth-normal, per kilogram of body weight every twenty-four hours.

potassium per kilogram every twenty-four hours. It would seem illogical to conclude that the increased urinary potassium represents potassium derived from intracellular fluids, though it is conceivable that this might be the case. With the persistently positive balance, the probability is that of the potassium absorbed from the gastro-intestinal tract into the blood stream less is stored in the tissues and more is excreted to bind acid. It will be noted that at the time of maximum excretion of potassium in both cases, the excretion of fixed acid was at a high point while the output of sodium was relatively low.

One may see, from table 2, that in the nine days following diuresis, the average twenty-four hourly excretion of the various urinary constituents varied very little from the fore-period average.

Feces.—The fecal excretion of the various elements did not seem to be affected by diuresis. The amounts of these substances in the stools seemed, in both cases, to remain extraordinarily constant. Any irregu-

15. Swanson, W. W., and Iob, L. V.: The Loss of Minerals Though the Skin of Infants, Paper presented at the meeting of the Society for Pediatric Research, May 3, 1932.

larities which occurred may certainly be considered as well within the limits of physiologic variation.

From these experiments it would seem that the diuresis evoked by the injection of a hypertonic solution of dextrose exerts no deleterious effects, certainly not so far as the fixed acid-base balance of the system is concerned. If the results are applicable to the treatment of gastro-intestinal intoxication with dehydration, the diuresis probably causes no additional depletion of the base beyond that resulting from the decreased intake which is the rule in these cases. In the two normal cases studied, the intake was, of course, entirely adequate. If transient losses of sodium and chlorides accompany dextrose diuresis in cases of gastro-intestinal intoxication, as in the two normal infants, this depletion may readily be overcome by the usual practice of accompanying the dextrose infusion by a saline clysis.

The hypertonic solution of dextrose used in these cases was more concentrated than is commonly used clinically, 20 per cent instead of the usual 10 per cent. It was given rather rapidly, each injection taking about half an hour. If the figure of 1 gram per kilogram of body weight every hour is accepted as the tolerance rate for dextrose of the average normal infant, in case 1 the patient received eight times, and in case 2, ten times this tolerance dosage. Both infants showed glycosuria. The first patient excreted 23 per cent and the second, 26 per cent of the total amount of dextrose injected. Thus these experiments represent an exaggerated picture of the usual clinical result, even in these not very striking changes which have been described.

SUMMARY

1. Diuresis was induced in two normal infants by the intravenous injection of a 20 per cent solution of dextrose. The urinary and fecal excretion of nitrogen, chlorides, phosphates, sodium and potassium was studied during the period of active diuresis and for the nine succeeding days.

2. There was a rapid loss of sodium and of chlorides in the urine during diuresis; but these losses were rapidly made up in the succeeding periods by the retention of sodium and of chlorides within the body, as indicated by the marked decrease in urinary output.

3. Fluctuations in the urinary excretion of the remaining ions during the entire period studied were insignificant.

4. Fecal excretion of these elements, and of calcium, showed no unusual change either during or after diuresis.

5. In these observations the use of a hypertonic solution of dextrose as a diuretic did not cause any prolonged depletion in the body of any of the elements studied.

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AGGLUTININS IN MOTHER'S BLOOD, BABY'S BLOOD, MOTHER'S MILK AND PLACENTAL BLOOD

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An increase in agglutinins against the enteric group of organisms was found in blood withdrawn during the convalescent stage when compared with that withdrawn during the acute stage of poliomyelitis.[1] In order to obtain information as to the agglutination titer of normal persons, among others, I tested the placental blood of new-born infants and coincidentally the serum of the mothers. Mother's blood was usually found to have a massive content of agglutinins against enteric organisms. On the other hand, the placental blood contained a relatively small amount of agglutinins.

In relative and fundamental experiments, Smith and Little[2] found Bacillus coli in large numbers in the spleen, liver and kidneys in calves that died of scours. They showed that calves fed colostrum were protected against this disease. It is possible that the serum of the dams contained protective antibodies.

Later, the same authors[3] showed that the serum of the adult cow could be used as a substitute for colostrum in new-born calves. By inference, they concluded that the immunity of calves receiving colostrum was due to the protective antibodies which tended to accumulate in the colostrum up to the time of parturition. Smith[4] found that the antibody content of the normal serum of the cow against B. coli was below that of colostrum from the same animal, and that its milk contained fewer agglutinins than did its serum. He noted that animals fed highly protective serum had no increase in

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1. Toomey, John A.: Agglutinin Titer Value Changes for Enteric Organisms in the Blood Serum of Patients with Poliomyelitis, J. Infect. Dis., to be published.

2. Smith, Theobald, and Little, Ralph B.: The Significance of Colostrum to the New-Born Calf, J. Exper. Med. **36**:181, 1922.

3. Smith, Theobald, and Little, Ralph B.: Cow Serum as a Substitute for Colostrum in New-Born Calves, J. Exper. Med. **36**:453, 1922.

4. Smith, Theobald: The Immunological Significance of Colostrum: I. The Relation Between Colostrum, Serum, and the Milk of Cows Normal and Immunized Towards B. Coli, J. Exper. Med. **51**:473, 1930.

agglutinins or in protective antibodies. One strain of enteric organisms (his strain 1192 B) was used in this work. Smith and Little [5] showed that not only colostrum but also adequate amounts of serum from normal cows or from those immunized with B. coli prevented the early fatalities due to B. coli. Such protection did not seem to them so complete, however, as that in the animals fed colostrum, since renal lesions or convulsions often developed within two months in the animals fed serum from normal cows or from cows immunized with B. coli. They demonstrated that milk alone, even that from highly immunized cows, was powerless to prevent rapid or delayed death. Smith and Little [6] stated that the placenta of the cow is impervious to agglutinins, since there is a definite absence of agglutinins in the serum of calves at birth, a time when the serum of the dam has an abundance of these antibodies.

Orcutt and Howe [7] stated that the blood of the normal new-born calf is lacking in agglutinins against Bacillus abortus. Agglutinins will appear quickly in the blood of calves fed colostrum from a cow, the blood serum of which has a high titer of B. abortus, sometimes as soon as three hours after the feeding, whereas the blood from a calf from which colostrum has been withheld will not contain an appreciable amount of agglutinins for at least twenty-four hours.

Various other authors have shown the increased immunologic activity of cow's milk: inhibition of streptococci,[8] inhibition of Bacillus typhosus [9] and germicidal activity.[10] Antibodies against the colon bacillus were always present in the blood serum of infants. The serum of mothers and infants showed the same relative strength of antibody reaction, though that of the serum of infants was slightly less and the infants lost their high serum antibody specificity soon after birth.[11]

5. Smith, Theobald, and Little, Ralph B.: The Immunological Significance of Colostrum: II. The Initial Feeding of Serum from Normal Cows and Cows Immunized Towards B. Coli in Place of Colostrum, J. Exper. Med. **51**:483, 1930.

6. Smith, Theobald, and Little, Ralph B.: The Absorption of Specific Agglutinins in Homologous Serum Fed to Calves During the Early Hours of Life, J. Exper. Med. **37**:671, 1923.

7. Orcutt, Marion L., and Howe, Paul E.: The Relation Between the Accumulation of Globulins and the Appearance of Agglutinins in the Blood of New-Born Calves, J. Exper. Med. **36**:291, 1922.

8. Jones, F. S., and Little, Ralph B.: The Bactericidal Property of Cow's Milk, J. Exper. Med. **45**:319, 1927.

9. Hanssen, Finn S.: The Bactericidal Property of Milk, Brit. J. Exper. Path. **5**:271, 1924.

10. Chambers, William H.: Bacterial Inhibition: I. Germicidal Action in Milk, J. Bact. **5**:527, 1920.

11. Weibel, Wilhelm: Serologisches und Klinisches über Schwangerschaftspyelitis: I. Ueber Antikörper im mütterlichen und fötalen Blute bei Schwangerschaftspyelitis, Arch. f. Gynäk. **99**:245, 1913.

Klieneberger [12] demonstrated the presence of colon bacillus agglutinins in the serum of new-born infants in dilutions as high as 1 : 160.

In the experiments performed to determine the agglutination titer of the blood of new-born infants and of mothers against the enteric group of organisms, agglutination against these organisms was always found in the placental serum. The titer at times reached 1 : 80, but rarely was higher. By comparison, there was massive agglutination against the same organisms in the mother's serum, the titer frequently being as high as 1 : 640. Specimens of serum of twenty-five mothers and of the placental serum of their new-born infants were examined. In no instance was there greater agglutination in the placental than in the mother's serum.

Specimens of the serum of ten breast-fed infants were withdrawn on the tenth day after birth, and the agglutination titer of each specimen was compared with that of the placental serum of the same child. In each instance, a marked accumulation of agglutinins against the colon bacillus had occurred in the blood serum within ten days after birth.

Milk obtained from mothers within twenty-four hours post partum and specimens obtained ten days later were compared. It was found that the former, or the colostrum milk, always contained a greater amount of agglutinins against enteric bacilli than was found in the specimens obtained ten days later. The milk in these experiments was skimmed and centrifugated to get rid of the fat. It was not precipitated by rennet to obtain the whey which contained the agglutinins, as has frequently been done by others with cow's milk,[13] as the amount of fat left, the depth of the color and the opacity of the fluid after centrifugation were not great enough to prevent a clearcut reading. With these facts in mind, it was thought interesting to determine coincidentally the comparative B. coli agglutination titer of various specimens as follows: placental blood, 10 day old baby's blood from the same patient, mother's milk at the time of delivery and mother's blood obtained the same day as the milk. The specimens were kept packed in ice, and experiments on the agglutination were performed simultaneously ten days later. Some loss in strength of agglutination may have occurred in the milk because of the delay, but comparative determinations of the agglutination titer of milk obtained within forty-eight hours and ten days after birth always showed a decreased amount of agglutinins in the second specimen.

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12. Klieneberger, Carl: Studien über Coliagglutinine unter besonderer Berücksichtigung der klinischen Verwertung von Coliagglutinationen, Deutsches Arch. f. klin. Med. **90**:267, 1907.

13. Smith, Theobald; Orcutt, Marion L., and Little, Ralph B.: The Source of Agglutinins in the Milk of Cows, J. Exper. Med. **37**:156, 1923.

Theobald Smith used one organism for his work on agglutination. I have frequently found that the blood serum of a patient may be definitely lacking in agglutinins for one enteric organism while having potent agglutinins against another strain. Because of this, as in former work, I used multiple strains of enteric organisms (twenty-one strains in all).

METHOD

The agglutination titer of each of the four specimens was determined against each of the strains used. The organisms were grown for two days on plain agar; the growth was scraped off into physiologic solution of sodium chloride and made up to a proper degree of turbidity with physiologic solution of sodium chloride. Fresh antigens were used for each experiment. The set-up of the experiment was as follows:

1. One cubic centimeter of saline colon antigen solution was put into each of four tubes. To each tube, 1 cc. of placental serum was added in the dilutions 1:20, 1:40, 1:80 and 1:160, respectively.

Agglutination Reactions of Various Specimens

	1:20 Dilution					1:40 Dilution					1:80 Dilution					1:160 Dilution				
	Positive				Negative	Positive				Negative	Positive				Negative	Positive				Negative
	4+	3+	2+	1+		4+	3+	2+	1+		4+	3+	2+	1+		4+	3+	2+	1+	
Placental blood	4	10	18	26	2	1	3	9	21	6	0	0	1	6	22	0	0	0	0	28
Baby's blood (10 days)	8	16	26	28	0	4	12	20	28	0	2	7	14	20	8	2	7	11	19	9
Mother's milk	10	19	27	28	0	7	13	26	28	0	0	4	8	21	7	4	5	9	19	9
Mother's blood	23	27	28	28	0	19	23	26	28	0	17	20	22	26	2	16	19	20	24	4

2. One cubic centimeter of saline colon antigen solution was put into each of four tubes. To each tube, 1 cc. of serum from a 10 day old baby was added in the dilutions 1:20, 1:40, 1:80 and 1:160, respectively.

3. One cubic centimeter of saline colon antigen solution was put into each of four tubes. To each tube, 1 cc. of mother's milk was added in the dilutions of 1:20, 1:40, 1:80 and 1:160, respectively.

4. One cubic centimeter of saline colon antigen solution was put into each of four tubes. To each tube, 1 cc. of mother's serum was added in the dilutions 1:20, 1:40, 1:80 and 1:160, respectively.

After incubation for one hour at 37 C., the tubes were placed in the icebox and read the next morning, about twenty-four hours later. Twenty-eight sets, or one hundred and twelve specimens, were examined.

The measures for the reactions were the same as those described previously.[1]

RESULTS

The number of 1, 2, 3 and 4 plus reactions obtained with each specimen in the dilutions 1:20, 1:40, 1:80; and 1:160 was separately tabulated, as in the accompanying table. It is easily seen that the

highest agglutinability was found in the mother's serum. The mother's milk and the specimen of blood from the 10 day old infant contained approximately equal amounts of agglutinins. No specimen of the placental serum showed a 3 plus reaction in the 1:80 dilution, and only six specimens showed a 1 and 2 plus reaction in that dilution. Four charts are appended which clearly show the relative agglutination titers of the specimens analyzed.

COMMENT

In these experiments, as well as in the preliminary experiments, I was able to find agglutinins against the enteric group in the placental serum, showing that in the human infant there is a definite transmission of agglutination factors through the placenta. The degree of transmission was comparatively slight, since there often was massive agglutination by the mother's serum in all tubes and in all dilutions with only slight agglutination by the placental serum. Even though the placental serum showed some agglutinins against the colon bacillus, I am inclined to believe that the placenta even in the human being has the tendency to filter out most of the agglutinins against the colon organisms.

Although the placenta contained some agglutinins, the blood of the same baby taken ten days later contained a much greater amount of agglutinins. The titer of the infant's serum in a general way paralleled that of the mother's milk. One might say, with allowances for experimental error, that the titers were about equal. This was true, as no specimen of either contained many more agglutinins than that of the other. This seems to indicate that the source of the agglutinins may be the milk.

The mother's first milk contained more agglutinins than did later specimens, yet in no instance was the agglutination titer greater than that of the mother's serum.

The production of agglutinins in the human being seems to be brought about, first by way of placental transmission and, second, by absorption of ingested agglutinins. The autoproduction of agglutinins by the infant cannot be definitely ruled out, though agglutinins against a colon organism usually do not increase in the human being unless there is an infection with this organism outside the gastro-intestinal tract. Such an infection did not occur in any of the patients studied. The experiments of Orcutt and Howe [7] also tend to show that agglutinins are absorbed from ingested milk.

In order to avoid erroneous conceptions of antibody content, it should be noted that in the human being any experiments on agglutination with enteric organisms must be performed with more than one organism.

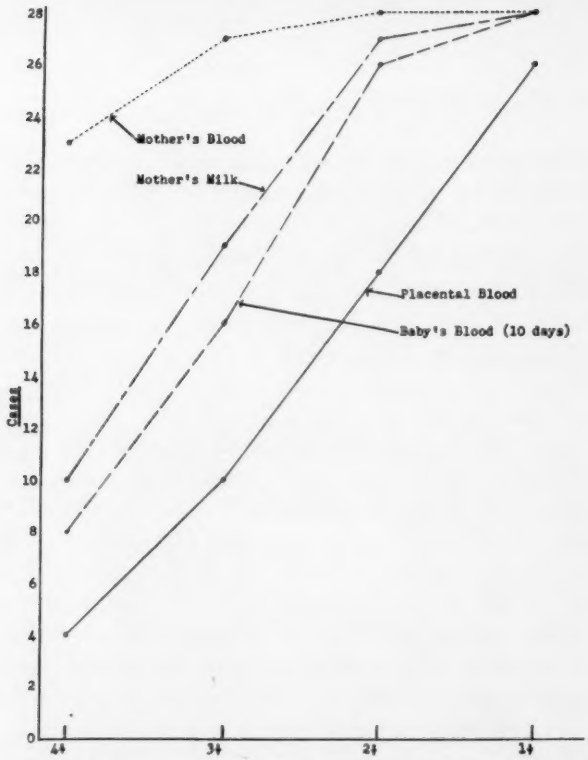

Chart 1.—Agglutination reactions in a dilution of 1:20. Negative reactions were obtained in two specimens of placental blood.

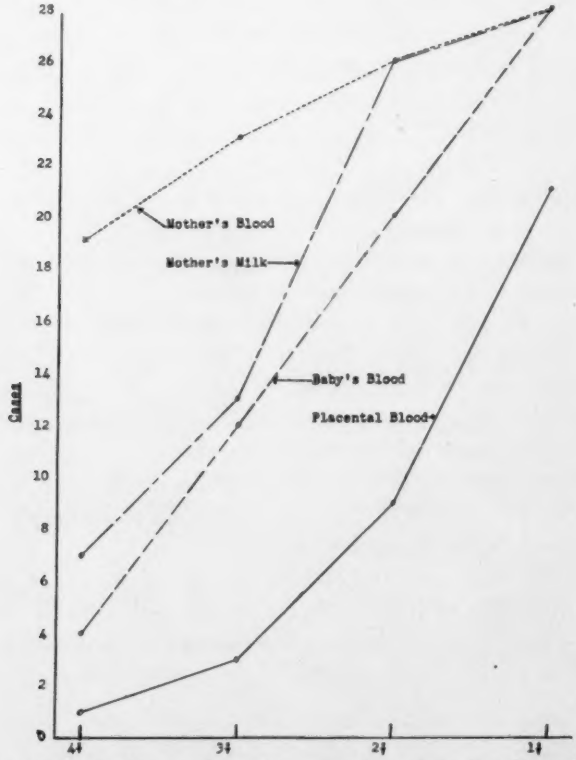

Chart 2.—Agglutination reactions in a dilution of 1:40. Negative reactions were obtained in six specimens of placental blood.

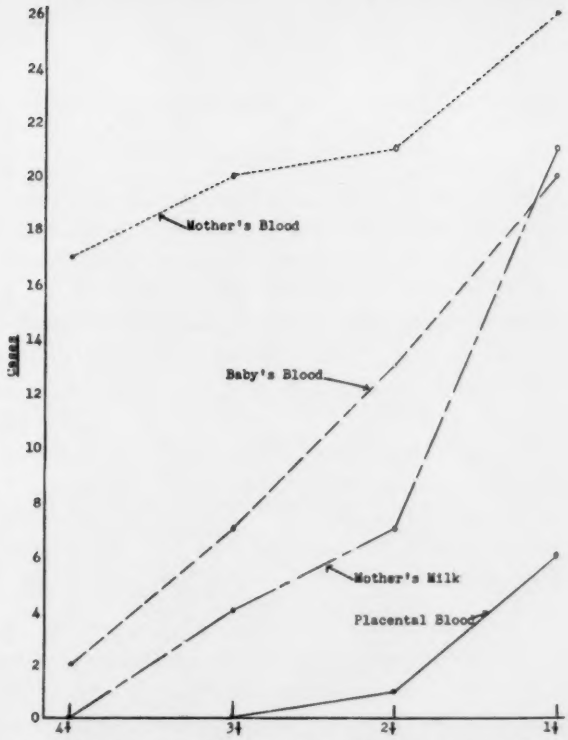

Chart 3.—Agglutination reactions in a dilution of 1 : 80. Negative reactions were obtained in twenty-two specimens of placental blood, in eight of baby's blood, in two of mother's blood and in seven of mother's milk.

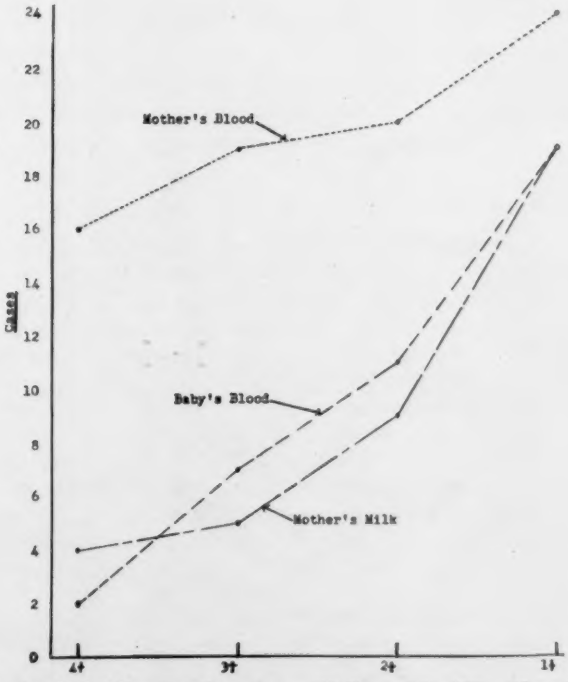

Chart 4.—Agglutination reactions in a dilution of 1 : 160. Negative reactions were obtained in twenty-eight specimens of placental blood, in nine of baby's blood, and of mother's milk and in four of mother's blood.

CONCLUSIONS

1. The placental blood of human infants contained agglutinins against the enteric group of organisms. In the specimens examined the agglutination titer usually did not go beyond 1 : 40, but occasionally it reached 1 : 80.

2. The mother's first milk and the specimen of blood taken from the infant ten days after birth showed a marked and about equal increase in agglutinins as compared with the placental blood from the same patient.

3. In the specimens examined, the mother's serum always contained massive agglutinins against the enteric group of organisms.

4. In the human being, a small amount of agglutinins against enteric organisms passes through the placenta. The later acquisition of an increased amount as shown by the agglutination titer is probably brought about by absorption from ingested milk.

COD LIVER OIL SENSITIVITY IN CHILDREN

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Cod liver oil and its concentrated forms have played an important rôle in the nutrition of infants. But like many other food substances they have at times been responsible for "upsets" in the allergic child, manifesting themselves in the form of vomiting, diarrhea, urticaria, eczema and asthma, or in a combination of these syndromes. Because of this frequent complication we have been searching for a product which could be given to children sensitive to cod liver oil, whose diets, for allergic reasons, have been inadequate in vitamin-containing foods.

One can readily appreciate the likelihood of dental caries and the lowered resistance to infection in any child whose diet must be limited to a few foods, and who in addition is unable to tolerate cod liver oil in any form.

We wish to report the cases of four allergic children in whom, owing to the addition of cod liver oil to their diets, various types of allergic manifestations developed other than the one for which they first came seeking relief, but who manifested no untoward symptoms when carotene concentrate fortified with vitamin D was substituted.

URTICARIA CAUSED BY COD LIVER OIL

CASE 1.—P. R. K., a girl, aged 4 years, was brought to the clinic recently because of asthma and urticaria, both of which were of two years' duration. The mother was intelligent and a good observer. She voluntarily remarked that the child's hives were related to the taking of cod liver oil. The child was always free from urticaria on leaving cod liver oil out of the diet. She had been given various brands and kinds of antirachitic oils, with the result that hives, and sometimes vomiting, always occurred. An allergic program for the asthma was outlined, and after a period in which the child was free from all symptoms we proposed that cod liver oil be given, as the diet was very inadequate in foods containing vitamin A. As in previous experiences, there were marked vomiting and urticaria. Cod liver oil was discontinued, and after a two weeks' interval another attempt was made to give cod liver oil, but, as on former occasions, the child had a severe case of urticaria. We then recommended a concentrate of

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carotene fortified with vitamin D. Following the ingestion of this there has not been any rash or vomiting, nor has there been any cumulative action.

The past history, except for asthma and urticaria, and the results of the physical examination were comparatively negative. Skin tests revealed positive reactions to various pollen, animal dander, some foods and cod liver oil.

Comment.—The child presented definite evidence of urticaria following the administration of cod liver oil. At no time has urticaria followed the giving of carotene concentrate fortified with vitamin D.

DIARRHEA CAUSED BY COD LIVER OIL

CASE 2.—R. F., a boy, aged 6 years, was brought to the outpatient department of the University of Oklahoma Medical School for the treatment of asthma of four years' duration. During the taking of the history it was revealed that cod liver oil was given to the child when he was an infant, but that it had to be discontinued because it caused vomiting, diarrhea and urticaria. The mother was advised to try to give the child cod liver oil again during the past winter because of dental caries. On three occasions this was attempted and following each attempt, diarrhea occurred.

Cod liver oil was tried once more under our care and another diarrhea cycle occurred. Other factors that might have caused this diarrhea were fairly well ruled out. Carotene concentrate was then used, in 5 drop doses, twice daily, without producing untoward symptoms.

Except for asthma and for occasional difficulty with urticaria and diarrhea due to cod liver oil, the child's past history was entirely negative. Intradermal testing revealed reactions to several foods, animal danders and cod liver oil.

Comment.—The question of a food diarrhea might be raised by some. This point was thoroughly investigated, and we learned that the only time diarrhea occurred in this child's life was when cod liver oil was administered, which was on four different occasions. We have followed this case for a number of weeks after carotene concentrate fortified with vitamin D was started, and up to the present no symptoms have appeared.

URTICARIA SECONDARY TO COD LIVER OIL

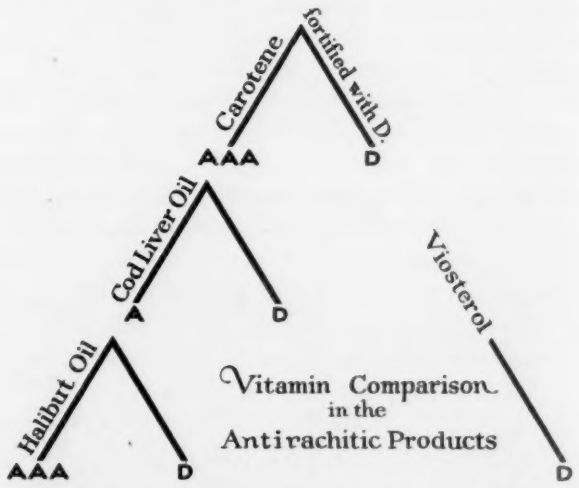
CASE 3.—L. P., a girl, aged 6 years, was brought to the clinic in 1931 because of asthma and hay fever. Treatment was outlined for the management of asthma and hay fever, and cod liver oil was recommended because of frequent upper respiratory infections and a marked faulty alinement of the teeth. After several trials with cod liver oil, a severe eruption of urticaria occurred. In each instance the mother became so alarmed that she decided all cod liver oil would be discontinued in this child's diet.

As we had found that many children who were sensitive to cod liver oil could tolerate carotene concentrate fortified with vitamin D, we decided to try the preparation in this case. Before giving it to the child we told the mother that further reaction would cause no harm, so cod liver oil was again tried, producing an urticaria. After waiting a few days we gave the patient carotene concentrate fortified with vitamin D, which was tolerated; at no time has it caused urticaria.

The personal history and the family history were normal except for the father's having hay fever. The physical examination revealed nothing unusual,

except an allergic rhinitis, faulty alinement of the teeth and some malnutrition. Both intradermal and skin tests were positive for many foods, pollens, animal dander and cod liver oil.

Comment.—This child's diet was unbalanced from a nutritional standpoint. Because of these various food withdrawals, cod liver oil has been advised and tried several times during the past two years. After each trial urticaria has appeared, irrespective of kind or brand of cod liver oil used. As we had found that other children who were sensitive to cod liver oil could tolerate carotene concentrate fortified with vitamin D, we tried this, and thus far the child has been free from all symptoms.



The diagram clearly demonstrates that "carotene concentrate fortified with vitamin D" is equivalent to cod liver oil and can therefore be satisfactorily substituted in the diet of children sensitive to cod liver oil.

ECZEMA MADE WORSE BY COD LIVER OIL

CASE 4.—R. W., a girl, aged 5 years, was first brought to the clinic in 1931 because of asthma and eczema. The child was found to be sensitive to various foods, pollens and animal danders. After wheat and egg had been withdrawn from the diet and milk had been limited the eczema materially improved.

Because of this limited diet cod liver oil was advised; the taking of it immediately caused the eczema to become worse, and also caused a generalized urticaria. We later found it possible to again add milk to the diet. After milk had been used in the diet for many months it was decided that cod liver oil be tried once more. As in former experiences, the eczema and urticaria recurred. After the cod liver oil was discontinued the urticaria and eczema disappeared.

We then added carotene concentrate fortified with vitamin D to the diet. At no time has there been any urticaria nor any aggravation of the mild eczema, which had always become generalized when cod liver oil was used.

The family history and the personal history in this case were normal. Skin tests showed strong reactions to many foods, pollens, animal danders and also to cod liver oil.

Comment.—This child's eczema was definitely made worse each time cod liver oil was used in the diet. After its removal, the eczema improved. Following the addition of carotene concentrate there has never been any urticaria, and the eczema has improved.

PREPARATIONS SUBSTITUTED FOR COD LIVER OIL

For children who develop allergic manifestations due to cod liver oil we have substituted carotene fortified with vitamin D. This product has a potency in vitamin A of approximately ten times that of cod liver oil. Because of this richness in vitamin A, one can readily appreciate its value for an allergic child whose diet is limited.

Since carotene, the active principle in the product, is of vegetable origin, one would naturally expect that a child born with the ability to become sensitive to cod liver oil would in turn develop a sensitization to carotene. However, owing to the method of extracting the principle with ether, all plant proteins have been eliminated. It is a hydrocarbon and is the specific pigment of carrot, hence the name "carotene." The vitamin D component which is added gives it a "D" equivalent to a regular cod liver oil. The concentration of vitamin D is such that 10 drops are equivalent to 3 teaspoonfuls of ordinary cod liver oil.

CONCLUSION

To our satisfaction we have clinically proved that children sensitive to cod liver oil can take carotene concentrate fortified with vitamin D satisfactorily. This product was tolerated by four children who after taking cod liver oil had urticaria, vomiting, eczema or diarrhea.

ACUTE POLIOMYELITIS

THERAPY BY BLOOD TRANSFUSIONS FROM IMMUNE DONORS

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The epidemic of poliomyelitis of 1931 in Brooklyn afforded a unique opportunity to investigate the effects of immune serum therapy on patients with poliomyelitis in its various stages. It was maintained by Flexner and Lewis [1] and by Landsteiner and Levaditi [2] that immune serum protects monkeys against infection with the poliomyelitis virus. Hence one would suspect that immune serum acts favorably also in the human species. The favorable effects of immunotherapy are expected only so far as the immune bodies can combat the infection and prevent impairment of the central nervous system. In cases, however, in which paralysis has set in, maintenance of life is the most that one can look for from such treatment, while the management of paralysis and its sequelae pertains to the realm of orthopedics and pediatrics.

I could not study the effects of animal serums as they were not available at the time. Convalescent serum, on the other hand, was easily obtained from persons who had acquired their immunity during the epidemics of 1916 or subsequently. These studies were made possible by the Pediatric Staff of the Israel-Zion Hospital, and Drs. Goldzieher, Gordon, Greenwald, Wallfield, Palinsky and Rosenblum were especially helpful. Administration of the serum was attempted in fifty-five cases, and doses of from 50 to 100 cc. were given intraspinally and intramuscularly. This series included thirty-two preparalytic and twenty-three paralytic cases. In the thirty-two preparalytic cases the mortality was three, or about 10 per cent, and in the paralytic cases about twice as high, 20 per cent. In the preparalytic group (twenty-nine), there was an incidence of paralysis in 50 per cent of the cases. According to these figures, the results both as to life and as to prevention of paralysis were not particularly encouraging. This experience tallies with that of others during the same epidemic. Gordon [3] stated that the mortality in all cases in Brooklyn during the epidemic of 1931 was about 10 per cent. The incidence of paralysis was 29 per cent and

From the Department of Laboratories of the Israel-Zion Hospital.

1. Flexner, S., and Lewis, P. A.: Experimental Poliomyelitis in Monkeys: Active Immunization and Passive Serum Protection, J. A. M. A. **54**:1781 (May 28) 1910.

2. Landsteiner and Levaditi: Compt. rend. Acad. d. sc. **58**:311, 1910.

3. Gordon, M. B.: New York State J. Med. **32**:1365, 1932.

higher than that, i. e., 39 per cent, in the cases in which serum was used. The higher rate of paralysis in the latter cases is probably explained by the selection of children for this procedure in whom the condition was apparently more severe. Park [4] claimed that serotherapy had no value in the treatment of poliomyelitis, while others more conservatively stated that the usefulness of such therapy required further corroboration by better controlled and more numerous statistical evidence (Kramer and co-workers [5]).

It seemed to me, however, that if serum therapy could achieve anything in poliomyelitis, the best results were to be expected from the administration of immune bodies by direct transfusions from donors who had successfully recovered from poliomyelitis. This seemed to be logical for various reasons:

1. Blood given by direct transfusion is not subject to any deterioration such as may befall serum obtained some time prior to its use and subjected to various procedures of conservation.

2. Administration of larger doses is possible by this method.

3. Instead of serum alone being given, all the other ingredients of the blood are also given. These include the leukocytes, the immunotherapeutic effects of which are perhaps not sufficiently appreciated. I may be permitted to point here to the possibility that some of the hormones circulating in the blood of a healthy adult donor may also contribute to an increased resistance of the recipient.

4. Immunotherapy is applied by the intravenous route. This point requires special consideration. Poliomyelitis is an acute infectious disease in which, according to all evidence, the infectious agent first circulates in the blood and only later, after a period of incubation, is conveyed to the meninges and the central nervous system. It would seem reasonable to introduce the immune bodies in their most concentrated form into that medium from which the infection is conveyed to the points of impairment. No less an authority than Schottmueller [6] recently emphasized this point and acknowledged the superiority of intravenous application of whatever immune bodies are introduced. The statistics published by Laidlaw [7] also point to the superority of intravenous medication as compared with other methods of administering immune bodies.

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4. Park, W. H.: Therapeutic Use of Antipoliomyelitis Serum in Preparalytic Cases of Poliomyelitis, J. A. M. A. **99**:1050 (Sept. 24) 1932.

5. Kramer, S. D.; Aycock, W. L.; Solomon, C. I., and Thenebe, C. L.: New England J. Med. **206**:432, 1932.

6. Schottmueller: Deutsche med. Wchnschr. **59**:43, 1933.

7. Laidlaw, F. W.: Poliomyelitis in the State of New York in 1931: A Preliminary Report of a Study of 1,559 Cases, J. A. M. A. **99**:1053 (Sept. 24) 1932.

On the basis of these considerations, seventy-one patients were treated with transfusions from immune donors. The amounts given varied from 150 to 400 cc. To one patient, two transfusions were given, while all others received only one. About half of the total number, that is, thirty-five, were in the preparalytic stage, while the other thirty-six were suffering from more or less grave paralytic symptoms when the transfusions were administered.

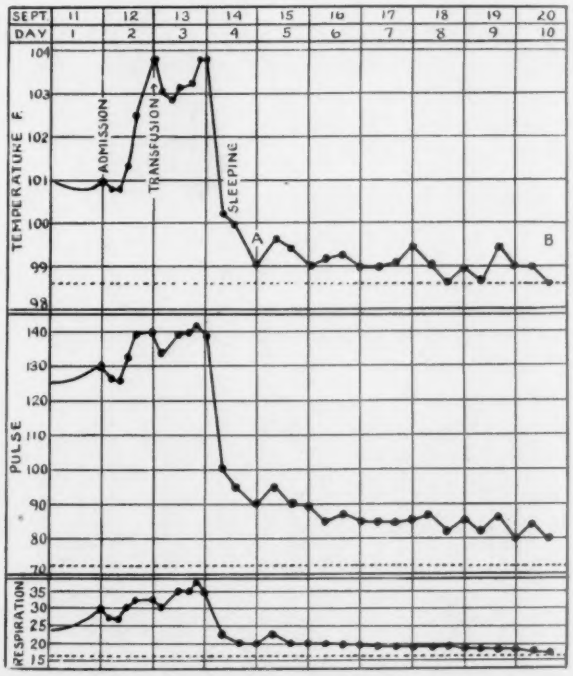

Chart 1 (case 1).—Hospital chart showing temperature, pulse and respiration curves of a patient who received a transfusion on the second day of illness with immediate reaction. The temperature after the second day up to the time of discharge (*A* to *B*) ranged from 98.6 to 99.6 F.

As shown by the table, the results were of a twofold nature. Mortality was reduced in the preparalytic cases to 2.8 per cent, and in the paralytic cases to 11 per cent. In this series two patients are included who were practically moribund at the time of transfusion. Still the mortality was lower than in the previously mentioned series of patients treated with serum, in which the corresponding figures were 10 and 20 per cent, respectively. The total mortality of the seventy-one patients was only 7 per cent as compared with the general rate of 10 per cent.

It is hard to assume that the decrease in mortality was due to anything but the transfusion, as these cases were not selected. A trans-

Data on Seventy-One Patients with Poliomyelitis Given Transfusions

PREPARALYTIC CASES

Number and Name	Sex and Age	Date of Onset	Chief Complaints	Physical Findings	Spinal Fluid	Temperature, F.	Pulse	Days Ill Before Transfusion	Date of Transfusion	Type of Transfusion	Hours of Fever After Transfusion	Result
1 M. G.	M 7	8/29/31	Vomiting; fever; rigidity of neck	Rigidity of neck; hyperactive deep and superficial reflexes	190 cells, 89% polymorphonuclears; albumin, globulin and sugar present; increased pressure	101	100	2	8/31/31	Type 4, 250 cc.	24	No paralysis
2 P. R.	M 7½	8/24/31	Gastric distress; pain in back of neck; stiffness of back	Moderate rigidity of neck; positive spine sign*	550 cells, 80% polymorphonuclears; albumin, globulin and sugar present; increased pressure	101.8	124	2	8/26/31	Type 1, 150 cc.	24	No paralysis
3 J. T.	M 10	10/ 4/31	Vomiting; fever	Rigidity of neck; drowsiness; slight rigidity of spine	340 cells, 65% polymorphonuclears	102	138	1	10/5/31	Type 4, phlebotomy, 100 cc. transfusion, 400 cc.	36	No paralysis
4 A. G.	M 4½	9/29/31	Headache; fever	Spine sign; pain in neck; rigidity of neck	40 cells, 90% lymphocytes; increased pressure	101	110	4	10/3/31	Type 3, 350 cc.	24	No paralysis
5 E. A.	F 8	9/30/31	Headache; pain in back; fever	Slight rigidity of neck and spine	500 cells, 85% lymphocytes	102.4	134	1	10/1/31	Type 2, 350 cc.	24	No paralysis
6 J. B.	M 8	10/15/31	Headache; vomiting	Slight spasm of neck and rigidity of spine	70 cells, 60% lymphocytes	100	115	1	10/16/31	Type 3, phlebotomy, 75 cc. transfusion, 200 cc.	36	No paralysis
7 R. DR.	F 6	10/18/31	Headache; vomiting	Slight rigidity of of neck	600 cells, 75% lymphocytes	102	128	1	10/19/31	Type 2, phlebotomy, 100 cc. transfusion, 300 cc.	36	No paralysis
8 M. G.	M 7	9/10/31	Pain in neck; fever	Moderate rigidity of neck and spine	190 cells, albumin and globulin present; increased pressure	98.6	100	1	9/11/31	Type 3, 250 cc.	24	Slight facial paralysis
9 A. O.	M 13	9/24/31	Headache; fever	Moderate rigidity of neck	1,200 cells, 65% polymorphonuclears; increased pressure	102.6	124	3	9/27/31	Type 4, 300 cc.	24	No paralysis
10 B. B.	M 7	9/27/31	Drowsiness; headache; abdominal pain	Moderate rigidity of neck; spine sign	700 cells, 65% lymphocytes	101	110	1	9/28/31	Type 2, 350 cc.	24	No paralysis
11 S. H.	F 5½	8/18/31	Fever; vomiting; stiffness of neck	Slight rigidity of neck	400 cells, 65% polymorphonuclears	103	120	1	8/19/31	Type 2, 200 cc.	24	No paralysis

* Spine sign: The patient is asked to sit up in bed. Pressure is exerted between the scapulae over the spine. Normally a patient will bend over; but in poliomyelitis the entire body, which is rigid, moves forward.

12 P. E.	F 5	8/18/31	Headache; pain in back of neck; vomiting	Rigidity of neck; hyperactive knee jerks and ankle jerks	900 cells, 90% polymorphonuclears	103.4	130	1	8/19/31	Type 2, 300 cc.	24	No paralysis
13 D. K.	F 6	9/19/31	Vomiting; drowsiness; pain in back of head; anorexia	Slight bilateral Kernig sign; hyperactive knee jerks; slight rigidity of neck	700 cells, 80% polymorphonuclears	102	100	1	9/20/31	Type 4, phlebotomy, 200 cc. transfusion, 400 cc.	24	No paralysis
14 M. W.	M 4	9/16/31	Pain in left leg; prostration; pain in upper extremities; difficulty in swallowing	Twitching and tremors; rigidity of neck; slight spine sign	90 cells, 100% lymphocytes; increased pressure	102	100	5	9/21/31	Type 1, 250 cc.	48	No paralysis
15 R. R.	F 2	9/17/31	Anorexia; irritability; fever; tremors	Hyperesthesia; rigidity of neck and spine	120 cells, 80% polymorphonuclears; normal pressure	101	100	7	9/24/31	Type 4, 300 cc.	48	No paralysis
16 M. G.	F 10	10/ 2/31	Headache; rigidity of neck; stiffness of back; vomiting	Rigidity of neck and spine	80 cells; globulin present; increased pressure	100.6	100	4	10/6/31	Type 4, phlebotomy, 120 cc. transfusion, 400 cc.	48	No paralysis
17 H. S.	M 34	9/15/31	Headache; nausea; fever	Headaches; rigidity of neck	100 cells, 70% polymorphonuclears, 30% lymphocytes; albumin, globulin and sugar present; increased pressure	100.4	100	7	9/22/31	Type 2, 350 cc.	24	No paralysis
18 S. B.	F 5	9/20/31	Vomiting; headache; stiffness of neck; drowsiness; abdominal pain	Hyperesthesia; slight rigidity of neck	400 cells, 85% polymorphonuclears	102	105	1½	9/22/31	Type 2, phlebotomy, 75 cc. transfusion, 350 cc.	48	No paralysis
19 Z. F.	M 14 mos.	9/14/31	Restlessness; fever; twitching	Occasional twitchings and tremors; rigidity of neck and spine	400 cells, 50% polymorphonuclears; increased pressure	102.8	110	2	9/16/31	Type 4, phlebotomy, 50 cc. transfusion, 250 cc.	120	Weakness of one foot
20 S. F.	M 3	9/ 1/31	Restlessness; fever	Extreme hypersensitivity of both lower extremities; slight rigidity of neck	210 cells, 65% polymorphonuclears	103	110	1½	9/3/31	Type 2, 250 cc.	48	No paralysis
21 M. L.	M 2½	9/ 6/31	Bronchitis cough; fever	Pain in neck; left knee jerk gone	210 cells, 65% polymorphonuclears	100	120	2	9/8/31	Type 2, 125 cc.	48	No paralysis
22 M. G.	F 10	10/ 3/31	Headache; vomiting; rigidity of neck; weakness	Rigidity of neck and spine	80 cells, 50% polymorphonuclears; increased pressure	100.6	100	2	10/5/31	Type 4, phlebotomy, 100 cc. transfusion, 400 cc.	24	No paralysis

Data on Seventy-One Patients with Poliomyelitis Given Transfusions—Continued

Number and Name	Sex and Age	Date of Onset	Chief Complaints	Physical Findings	Spinal Fluid	Temperature, F.	Pulse	Days Ill Before Transfusion	Date of Transfusion	Type of Transfusion	Hours of Fever After Transfusion	Result
23 J. P.	M 4½	8/26/31	Headache; pain in back of neck	Rigidity of neck and spine	310 cells, 90% lymphocytes and 10% polymorphonuclears; globulin, albumin and sugar present	102	124	1	8/27/31	Type 2, 225 cc.	36	No paralysis
24 G. H.	M 12	8/23/31	Unwell feeling; fever for 7 days	Neck and spine rigid; knee jerks sluggish	200 cells; 70% polymorphonuclears and 30% lymphocytes; globulin present; 2+ albumin	102	110	7	8/30/31	Type 2, 300 cc.	24	No paralysis
25 T. S.	F 6	8/25/31	Headache; nausea; vomiting	Stiffness of back; rigidity of neck and spine	450 cells, 90% polymorphonuclears	102.4	116	1	8/26/31	Type 1, 300 cc.	96	Paralysis of lower and upper extremities and weakness of neck and lumbar muscles
26 W. B. M.	M 9	9/ 3/31	Headache; rigidity of neck; hyperesthesia; tremors	Rigidity of neck and spine; hyperactive deep reflexes; spine sign	540 cells, 90% polymorphonuclears; albumin and globulin present; increased pressure	102.2	114	5	9/8/31	Type 2, 300 cc.	24	No paralysis
27 R. H.	M 3	9/ 2/31	Headache; drowsiness	Rigidity of neck; positive spine sign	160 cells, 60% polymorphonuclears and 40% lymphocytes; globulin present	101	140	6	9/8/31	Type 2, 250 cc.	36	No paralysis
28 I. R.	M 6	9/ 8/31	Cold; cough	Rigidity of neck and spine	90 cells, 50% polymorphonuclears; 2+ globulin	100	97	1	9/9/31	Type 4, 250 cc.	24	No paralysis
29 A. R.	M 7	8/21/31	Dizziness; stiffness of neck; weakness of right foot	Stiffness of back and legs; stiffness of neck	120 cells, 60% polymorphonuclears; increased pressure	100.8	138	2	8/23/31	Type 2, 200 cc.	36	No paralysis
30 J. L.	M 5	8/27/31	Fever; vomiting; headache	Slight rigidity of neck and spine	70 cells, 80% polymorphonuclears; increased pressure	101	132	3	8/30/31	Type 3, 250 cc.	24	No paralysis
31 E. B.	M 3½	8/16/31	Fever; weakness; restlessness; vomiting	Rigidity of neck; spine sign	120 cells, 74% lymphocytes	101.6	118	4	8/20/31	Type 2, 190 cc.	48	No paralysis
32 G. F.	M 6	9/ 4/31	Vomiting; headache; drowsiness	Rigidity of neck; spine sign; drowsiness	400 cells, 90% polymorphonuclears	104	120	1	9/5/31	Type 3, 200 cc.	..	Death

33 S. S.	F 2	9/10/31	Vomiting; fever	Rigidity of neck and spine	125 cells, 80% polymorphonuclears	102	110	2	9/12/31	Type 2, phlebotomy, 100 cc. transfusion, 200 cc.	28	No paralysis
34 A. R.	M 4	8/ 4/31	Headache; vomiting; restlessness	Rigidity of neck; spine sign	236 cells, 60% lymphocytes	102	120	4	8/8/31	Type 2, 200 cc.	30	No paralysis
35 E. McG.	M 4	8/ 1/31	Headache; vomiting	Rigidity of neck; spine sign	700 cells, 90% polymorphonuclears	104	125	2	8/3/31	Type 4, 200 cc.	30	No paralysis
					PARALYTIC CASES							
36 M. B.	M 1	8/14/31	Fever; restlessness; vomiting	Rigidity of neck and spine; paralysis of both lower extremities; inability to sit up	Bloody fluid on tapping	101.8	144	6	8/20/31	Type 3, 175 cc.	24	Partial paralysis of both lower extremities
37 M. S.	F 4	8/28/31	Headache; fever; muscular pains; tremors	Difficulty in deglutition; drowsiness; weakness; hyperesthesia; slight rigidity of neck; left facial palsy; weakness of right lower extremity	100 cells, 80% lymphocytes; albumin, globulin and sugar present	101.4	128	4	9/1/31	Type 2, 250 cc.	24	Some residual paralysis of right lower extremity slight facial palsy
38 B. S.	F 1½	8/28/31	Drowsiness; fever; inability to walk or stand	Rigidity of neck and spine sign; absence of knee jerks on the right side; paralysis of the right leg	280 cells, 100% lymphocytes; albumin, globulin and sugar present	99.8	120	4	9/1/31	Type 3, 200 cc.	24	Weakness of right leg
39 C. T.	M 11	8/29/31	Pain in chest and abdomen; headaches; inability to raise both lower extremities	Rigidity of neck; mucopurulent discharge from nose; flaccid paralysis of both lower extremities; weakness of upper extremities	590 cells, 89% polymorphonuclears and 11% lymphocytes; pressure increased	100.2	128	3	9/1/31 (2d) 9/2/31	Type 2, (1) 300 cc. (2) 200 cc.	24 hrs. after 2d transfusion	Weakness of back; ability to raise right leg and rotate left leg; use of arms
40 C. N.	M 9	8/23/31	Frontal headache; sore throat; fever	Facial palsy; dysphagia; change in voice; fine horizontal nystagmus; rigidity of neck	70 cells, 50% polymorphonuclears; globulin present	99.4	106	4	8/27/31	Type 2, 300 cc.	24	Facial palsy
41 A. R.	M 9	9/21/31	Vomiting; rigidity of neck; difficulty in swallowing	Facial and palatine paralysis; nasal twang to voice	600 cells, 70% lymphocytes; albumin present; pressure increased	103	120	4	9/25/31	Type 2, 300 cc.	48	Facial palsy
42 L. C.	M 5	9/10/31	Regurgitation of food through nose; fever; difficulty in swallowing	Facial palsy; weakness of right side of face; drooping of the soft palate, and inability to swallow	400 cells, 80% lymphocytes; albumin, globulin and sugar present; pressure increased	102	110	5	9/15/31	Type 4, phlebotomy, 100 cc. transfusion, 300 cc.	36	Facial palsy

Data on Seventy-One Patients with Poliomyelitis Given Transfusions—Continued

Number and Name	Sex and Age	Date of Onset	Chief Complaints	Physical Findings	Spinal Fluid	Temperature, F.	Pulse	Days Ill Before Transfusion	Date of Transfusion	Type of Transfusion	Hours of Fever After Transfusion	Result
43 D. J.	F 6	9/15/31	Headaches; rigidity of neck and spine; vomiting	Facial paralysis; paralysis of right lower extremity; weakness of left upper extremity	320 cells, 75% lymphocytes; albumin, globulin and sugar present	100	100	3	9/18/31	Type 3, phlebotomy, 100 cc. transfusion, 250 cc.	30	Slight facial paralysis; weakness of right lower extremity
44 S. G.	F 3	9/30/31	Inability to stand or walk	Rigidity of neck and spine; absence of reflexes in lower extremities	150 cells, 60% lymphocytes; increased pressure	101	120	5	10/5/31	Type 2, 225 cc.	32	Recovery
45 M. M.	M 5	8/22/31	Vomiting; drowsiness; fever	Loss of reflexes of upper and lower extremities and of abdomen; weakness of intercostal muscles	600 cells, 80% lymphocytes; albumin, globulin and sugar present; increased pressure	103	115	4	8/26/31	Type 3, phlebotomy, 200 cc. transfusion, 300 cc.	36	Weakness of abdominal muscles; weakness of right foot and left thigh
46 F. D.	M 8	9/ 7/31	Drowsiness; vomiting	Rigidity of neck and spine; weakness of right side of face; paralysis of soft palate	100 cells, 70% lymphocytes; increased pressure	102	110	5	9/12/31	Type 4, phlebotomy, 250 cc. transfusion, 350 cc.	24	Right facial palsy
47 N. B.	M 18	9/ 4/31	Abdominal cramps; fever; weakness of right lower extremity	Rigidity of neck; weakness of back; facial paralysis; absence of knee jerks; weakness of both lower extremities	140 cells, 90% lymphocytes; increased pressure	102	118	7	9/11/31	Type 4, phlebotomy, 200 cc. transfusion, 400 cc.	24	Ability to move both legs and to sit; inability to stand
48 P. K.	F 4½	9/29/31	Headache; cough; stiffness and pain in back of neck	Facial palsy; nasal twang; rigidity of spine and neck	50 cells, 70% polymorphonuclears; albumin, globulin and sugar present	101.6	124	7	10/6/31	Type 2, phlebotomy, 150 cc. transfusion, 350 cc.	24	Slight right facial palsy
49 S. Z.	F 2	8/25/31	Restlessness; irritability; fever	Dysphagia; paralysis of palate; rigidity of spine and neck; inability to move arms or legs; weakness of intercostal and abdominal muscles	60 cells, 100% lymphocytes; albumin, globulin and sugar present	99.4	124	4	8/29/31	Type 3, 200 cc.	24	Strabismus; right facial palsy; weakness of back and neck muscles; partial paralysis of upper and lower extremities

50 G. S.	F 4	8/23/31	Fever; stiffness of neck and back	Weakness of right lower and right upper extremities; right facial palsy; rigidity of spine; paralysis of intercostal and abdominal muscles; cyanotic lips, face and hands; imperceptible pulse	300 cells, 95% lymphocytes; albumin, globulin, sugar present; increased pressure	102	132	4	8/27/31	Type 2, 275 cc.	..	Death
51 L. M.	M 8½	9/ 8/31	Vomiting; headache; rigidity of neck; nasal twang; difficult breathing	Left facial paralysis; weakness of abdominal and intercostal muscles; abdominal respiration	350 cells, 68% lymphocytes; pressure increased	100	98	2	9/10/31	Type 2, 300 cc.	48	Slight facial palsy
52 I. R.	F 5½	7/29/31	Fever; drowsiness; stiffness of neck; vomiting; tremors	Weakness of right deltoid; rigidity of neck; nasal twang; right facial palsy; paralysis of palate	650 cells, 80% polymorphonuclears; albumin, globulin, sugar present; increased pressure	101.2	130	8	8/6/31	Type 2, 180 cc.	24	Recovery
53 A. R.	M 7½	9/25/31	Vomiting; nasal twang	Rigidity of neck; right facial palsy; uvula pulled to the left	100 cells, 100% lymphocytes; albumin, globulin, sugar present; increased pressure	103	148	1	9/26/31	Type 3, 300 cc.	24	Right facial palsy
54 S. C.	F 15 mos.	9/23/31	Fever; drowsiness	Rigidity of neck and spine; weakness of back; weakness of both upper extremities; absence of knee jerks	80 cells, 60% lymphocytes; increased pressure	100	160	3	9/26/31	Type 3, phlebotomy, 150 cc. transfusion, 300 cc.	24	Partial paralysis of left upper extremity; complete paralysis of right and left deltoid
55 D. Z.	M 12½	8/21/31	Fever; vomiting; diplopia	Left facial palsy; sluggish knee jerks; nasal twang	215 cells, 90% lymphocytes; albumin, globulin, sugar present	100	100	5	8/26/31	Type 1, 300 cc.	24	Left facial palsy
56 P. M.	M 4	8/ 1/31	Sore throat; paralysis of right leg	Reflexes of right lower extremity gone; leg flaccid	350 cells, 70% polymorphonuclears; albumin, globulin, sugar present; increased pressure	104 for 19 days	130	12	..... 8/13/31 8/19/31 8/20/31	Type 4, 400 cc. plain donor 400 cc. plain donor phlebotomy, 300 cc. transfusion from immune donor, 400 cc.	*	Paralysis of right leg
57 D. C.	M 3	9/17/31	Generalized pains; fever	Rigidity of neck and spine; complete paralysis of left lower extremity	50 cells, 75% lymphocytes; globulin present; increased pressure	101	120	6	9/23/31	Type 4, 300 cc.	30	Partial paralysis of left leg

* After third transfusion, temperature came to normal in 24 hours.

Data on Seventy-One Patients with Poliomyelitis Given Transfusions—Continued

Number and Name	Sex and Age	Date of Onset	Chief Complaints	Physical Findings	Spinal Fluid	Temperature, F.	Pulse	Days Ill Before Transfusion	Date of Transfusion	Type of Transfusion	Hours of Fever After Transfusion	Result
58 N. B.	M 10½	9/13/31	Headache; pain in back; inability to move arms and legs	Progressive paralysis of arms, legs, abdomen and intercostals	170 cells, 75% lymphocytes; globulin present; increased pressure	101	130	9	9/22/31	Type 3, phlebotomy, 200 cc. transfusion, 350 cc.	72	Partial paralysis or arms and legs; weakness of abdominal muscles
59 A. G.	F 3	9/21/31	Vomiting; nasal twang; tremors	Rigidity of neck and spine; right facial and palatine palsy; right knee jerk absent; left knee jerk weak	100 cells, 50% polymorphonuclears; increased pressure	101.5	125	2	9/23/31	Type 2, 300 cc.	36	Weakness of right lower extremity
60 M. G.	F 3½	9/24/31	Fever; rigidity of neck; restlessness	Rigidity of neck and spine; right facial palsy; nasal twang; paralysis of all extremities and intercostal muscles	890 cells, 95% polymorphonuclears; albumin, globulin, sugar present; increased pressure	102.4	130	1	9/25/31	Type 4, 300 cc.	48	Complete paralysis of lower extremities; weakness of both upper extremities, and intercostal muscles
61 R. H.	M 8	9/25/31	Headache; fever; cramps; pain in chest	Marked rigidity of neck and spine; left facial palsy; nasal twang; weakness of both thighs; paralysis of soft palate; regurgitation through the nose	520 cells, 95% polymorphonuclears; albumin, globulin, sugar present; increased pressure	102	140	5	9/30/31	Type 4, phlebotomy, 200 cc. transfusion, 400 cc.	..	Death
62 J. L.	F 2½	8/ 2/31	Fever	Rigidity of neck and spine; internal strabismus of right eye	120 cells, 68% polymorphonuclears; albumin, globulin, sugar present; increased pressure	101	120	1	8/3/31	Type 2, 200 cc.	36	Recovery
63 L. S.	F 12	10/14/31	Pain in back; fever; inability to move arms or legs	Rigidity of neck; paralysis of both legs, right arm, left deltoid, abdominal and intercostal muscles	300 cells, 80% polymorphonuclears; albumin, globulin, sugar present	102	120	3	10/17/31	Type 2, phlebotomy, 100 cc. transfusion, 400 cc.	100	Paralysis of right leg and partial left leg; weakness in left arm, right arm and abdominal muscles

64 H. L.	M 15	8/24/31	Fever; headache; inability to lift head; nasal twang	Delirium; cyanosis; paralysis of soft palate, face and both lower extremities; patient very toxic; condition very poor	180 cells, 80% lymphocytes; increased pressure	105	150	4	8/28/31	Type 4, 400 cc.	..	Death
65 E. L.	M 2	9/20/31	Inability to stand or move left arm	Left knee jerk absent; right knee jerk sluggish; paresis of left deltoid and right leg	1,100 cells, 90% polymorphonuclears; albumin, globulin, sugar present; increased pressure	101	110	2	9/22/31	Type 2, 300 cc.	48	Deltoid weakness and paralysis of four muscles of the right leg
66 M. S.	M 4	9/25/31	Fever; sore throat; inability to stand, sit or move legs	Nasal twang; right facial palsy; paralysis of both lower extremities and deltoids shallow breathing	130 cells, 65% polymorphonuclears	103	120	5	9/30/31	Type 3, phlebotomy, 150 cc. transfusion, 350 cc.	72	Weakness of right forearm, partial paralysis of both lower extremities
67 M. S.	F 3½	8/18/31	Vomiting, fever, sore throat; pain in back of neck	Weakness of both lower extremities and right forearm; rigidity of neck and spine	440 cells, 60% polymorphonuclears	102	118	8	8/26/31	Type 1, 250 cc.	36	Partial paralysis of right forearm
68 D. H.	F 4	8/22/31	Facial palsy; nasal twang; difficulty in swallowing	Deviation of the uvula; paresis of the palate; rigidity of neck and spine	300 cells, 80% polymorphonuclears; albumin, globulin, sugar present	102	100	3	8/25/31	Type 2, 300 cc.	48	Slight facial palsy
69 E. N.	M 8	10/11/31	Vomiting; fever	Rigidity of neck and spine; right facial palsy; paresis of the palate and lower extremities; absence of reflexes	600 cells, 80% polymorphonuclears; increased pressure	103	120	1	10/12/31	Type 2, phlebotomy, 150 cc. transfusion, 400 cc.	..	Death
70 A. F.	F 2½	8/23/31	Vomiting; fever; weakness of the back and right leg	Rigidity of spine and neck; loss of reflexes; partial paralysis of right leg and lumbar muscles	40 cells, 90% lymphocytes; albumin, globulin, sugar present	99	100	7	8/30/31	Type 2, 250 cc.	24	Slight weakness of right leg
71 H. S.	M 5½	8/23/31	Headache; vomiting; anorexia	Rigidity of spine and neck; hyperesthesia; polyneuritis; facial palsy	100 cells, 100% polymorphonuclears; globulin present; increased pressure	102	140	8	8/31/31	Type 4, 250 cc.	24	Slight facial palsy

fusion was given to every patient for whom the consent of the family physician or of the patient's family could be obtained. As a matter of fact, the deaths included those of the two patients mentioned who were practically moribund at the time of the transfusion.

The effect of transfusion on the incidence of subsequent paralysis is even more gratifying. There were only three cases in the preparalytic group, or a percentage of 8.8 per cent, as compared with 50 per cent

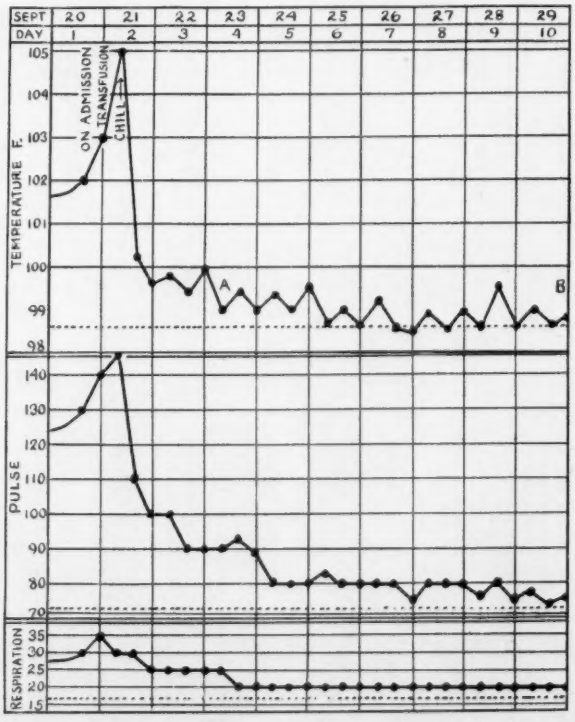

Chart 2 (case 13).—Hospital chart showing temperature, pulse and respiration curves of a patient who received a transfusion on the first day of illness. The temperature dropped after one day and thereafter (*A* to *B*) ranged from 98.4 to 99.6 F.

in the group in which convalescent serum was given. The advantage of transfusion is also shown if these percentages are compared with Gordon's [3] 29 and 39 per cent, respectively.

It would seem from the table that the development of destructive lesions in the central nervous system can be prevented by timely transfusions. It is difficult, however, to express the benefit thus derived in exact figures, as the number of cases in which paralysis does not develop in spite of definite infection and the lack of specific treatment, cannot be estimated.

The benefit of transfusion, however, becomes more readily demonstrable if the question of paralysis is temporarily disregarded and poliomyelitis is looked on merely as an acute infectious condition which runs a certain febrile course up to death or recovery. The effect of transfusion on the acute symptoms of poliomyelitis such as fever, prostration, disturbance of sensorium, headache, vomiting and general state of toxemia is striking. In a large number of the cases in this series, transfusion was followed by a critical change in the patient's condition. This change is perhaps most strikingly brought out by the temperature curves.

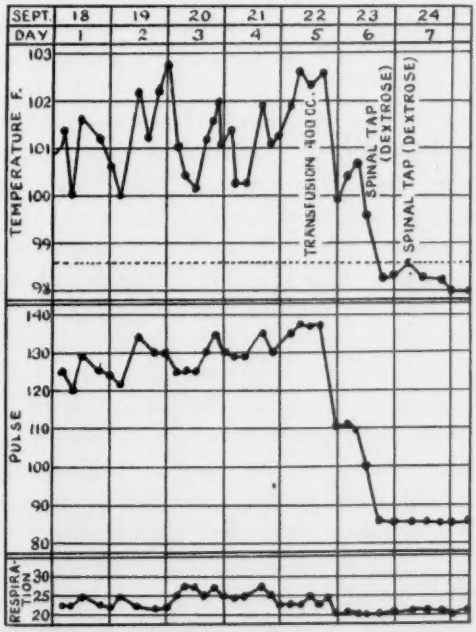

Chart 3 (case 47).—Hospital chart showing temperature, pulse and respiration curves of a paralyzed patient to the seventh day of illness. The temperature subsided twenty-four hours after transfusion.

Some conclusions can be deducted also from the table if one considers how long febrile temperature persisted after transfusion. Within twenty-four hours, the temperature was afebrile in thirty-two cases (that is, 45 per cent). Fever abated within forty-eight hours in twenty-nine cases (14 per cent). When these figures are compared with those for the fifty-five patients treated with injections of convalescent serum, one finds that in the latter the fever lasted on an average for one hundred hours as compared with thirty-six hours in the patients who were given transfusions; there were only 13 per cent in whom the fever ceased twenty-four hours later, and 27 per cent in whom the

temperature returned to normal in forty-eight hours. Sixty per cent of this series remained unimproved compared with 14 per cent in the group given transfusions.

COMMENT

A series of seventy-one patients is obviously too small to justify sweeping conclusions. Yet the results obtained are so encouraging that it would seem that treatment by transfusion should be given a fair trial in the future. This conclusion would be reasonable on the basis of the material published in this paper. It is more so in view of the fact that Schottmueller,[6] the leading authority in the field of infectious diseases abroad, has felt justified in stating that transfusion with blood of convalescent donors is the method of choice in the treatment of acute poliomyelitis.

An important feature of successful immunotherapy is the proper organization of blood donors. As soon as the first transfusions were given with striking effect, it appeared necessary to assure a satisfactory supply of donors. It was not difficult to organize within a short time a group of 130 donors in which all the known blood groups were represented. These donors were available at telephone call; the blood of each was typed, and a Wassermann test was performed in order to eliminate persons with syphilis. Many of the donors showed evidence of paralysis. The nonparalytic ones were shown to have had poliomyelitis on evidence obtained from hospital records or by the testimony of the physicians who had treated them during their illness. The same evidence was also gathered with respect to the paralytic ones.

Transfusions were given by the direct method with the Soresi instrument. In order to introduce sufficiently large amounts of immune blood, it seemed necessary to perform a phlebotomy on the patient and remove from 100 to 200 cc. of his blood. With this procedure, transfusions of amounts as large as 400 cc. could be given without embarrassing the circulation of the patient.

It should not be left to individual initiative to organize a supply of immune donors for the treatment of poliomyelitis with transfusions. This task could be handled most efficiently by the health authorities, who should establish a register of all convalescent persons for use in the enlistment of donors in future epidemics, or by a community central place under the auspices of a bureau as proposed by Gordon.[3]

CONCLUSIONS

1. Seventy-one cases of acute poliomyelitis in which transfusions from convalescent donors were given are reported.

2. The results obtained are compared with those observed after injection of convalescent serum and those reported in other statistics during the same epidemic.

3. Transfusion from immune donors decreases the mortality, and if given during the preparalytic stage decreases the incidence of paralysis. It favorably influences the course of the infectious symptoms and is conducive to an almost critical improvement of the patient in the majority of cases.

4. Transfusion from immune donors appears to be the method of choice in the treatment of acute poliomyelitis.

5. It is suggested that health authorities or a central bureau provide for registration of convalescents in order to have donors available at the time of a new epidemic.

FOOD REQUIREMENT OF GIRLS FROM SIX TO THIRTEEN YEARS OF AGE

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Since Jan. 1, 1931, considerable information has been accumulated at University Hospital, Ann Arbor, Mich., on the dietary habits of girls between the ages of 6 and 13 who are maintained on a diet suitable for growing children. The observations have formed part of a study in which the effects of a well selected diet on the presence of Bacillus acidophilus in the mouth and stools and on the chemical composition of the blood and the saliva were noted for correlation with the development of immunity or susceptibility to dental caries. Subsequent reports will be made of the latter findings.

In view of the scarcity of quantitative records of the dietary intakes of children measured for more than from four to ten days, it seemed desirable to publish our findings for twenty-eight girls who were fed a uniform type of diet for periods varying from twenty-eight to one hundred and ninety-two consecutive days. In this report our findings are compared with the results of previous work as compiled by Gillett [1] in 1917 and later published in the report of the White House Conference on Child Health and Protection,[2] with the findings and recommendations of Holt and Fales [3] and with the results of the observations of Wait and Roberts.[4]

These studies were part of an organized research into the cause of dental caries conducted at the University of Michigan under the direction of Dr. R. W. Bunting of the School of Dentistry and under the auspices of the Children's Fund of Michigan.

1. Gillett, Lucy H.: A Survey of Evidence Regarding Food Allowances for Healthy Children, Bureau of Food Supply, The New York Association for Improving the Condition of the Poor, publ. 115, 1917.

2. White House Conference on Child Health and Protection: Growth and Development of the Child: Nutrition, New York, Century Company, 1932.

3. Holt, L. E., and Fales, H.: (*a*) The Food Requirement of Children: I. Total Caloric Requirement, Am. J. Dis. Child. **21**:1 (Jan.) 1921; (*b*) II. Protein Requirement, ibid. **22**:371 (Oct.) 1921; (*c*) III. Fat Requirement, ibid. **23**:471 (June) 1922; (*d*) IV. Carbohydrate Requirement, ibid. **24**:44 (July) 1922; (*e*) V. Percentage Distribution of Calories, ibid. **24**:311 (Oct.) 1922.

4. Wait, B., and Roberts, L. J.: (*a*) Studies in the Food Requirement of Adolescent Girls: I. The Energy Intake of Well-Nourished Girls, J. Am. Dietet. A. **8**:209 (Sept.) 1932; (*b*) II. Daily Variations in Energy Intake of the Individual, ibid. **8**:323 (Nov.) 1932; (*c*) III. The Protein Intake of Well-Nourished Girls Ten to Sixteen Years of Age, ibid. **8**:403 (Jan.) 1933.

The subjects of our investigations were young girls who were hospitalized because of acute gonorrheal vaginitis. They were apparently normal children, playing out of doors regularly under supervision and attending school within the hospital. Our long experience in working with them convinced us that they behaved as normal, healthy, well trained children in their reactions to food. We and the physicians in charge believe that after an initial period of polyuria their metabolic processes were normal. Medical treatment was in large part localized or of such a nature as not to interfere with normal metabolism. Some of the girls were hospitalized for more than one and a half years; others, for only eight or ten weeks.

A series of standard menus [5]—one for each day of the week—has been in constant use. During the early part of 1931, the menus were changed frequently to simplify the work in the kitchens, where all of the cooked food for the group had to be prepared quantitatively, and to substitute foods equally valuable nutritionally for some articles originally included which almost all of the children had difficulty in eating. Minor changes were made from time to time, such as the substitution of fresh fruits in season for canned fruits.

With one or two exceptions—one of these (number 2) was an undernourished girl of foreign parentage to whom most of the foods were new—we had no difficulty in persuading the children to eat everything offered. They ate their meals with apparent enjoyment, and extra helpings even of fish, liver and spinach have been common. Several of the girls who were in the group for over eighteen months ate as satisfactorily at the end of that time as at the beginning. From our experience, children do not object to repetition of menus on fixed days of the week if they like the food—in fact, they seem to prefer uniformity in food to constant change.

Foods were prepared quantitatively, and the final weights of cooked products were recorded for use in the calculations. All of the portions of each item on the menu were weighed for each child daily, additional weighed portions being served as desired after the first helpings of the main meal had been eaten. Second helpings of dessert—except in the case of fruit—were not given to a child who had not eaten everything previously offered. The weight of the first portions was always adjusted to the size and the appetite of the individual child. If all of the children repeatedly asked for second helpings of a given item on the menu, the size of the first portion offered was increased. If a child occasionally was unable to eat everything on her plate, no attention was paid, except to weigh what had been left or perhaps to withhold the dessert. If this persisted and she continued to gain normally in weight, the size of her

5. Copies of the menus will be available on request.

first portions was reduced. If she did not gain satisfactorily in weight, as in a few instances, we gave her small daily portions of dried yeast with resultant gradual improvement of appetite. The children have, on the whole, had very good appetites. The only foods not on the menus that the children were permitted to eat were fresh fruits or nuts that were brought in by relatives. The desired edible portions of all such foods were always weighed, however, the weights being included in the intake of food for the day.

The menus were continued for ten weeks during the summers of 1931 and 1932, and the same general policies were followed at mealtime, but the portions were not weighed.

A daily record was kept of the weights of the various foods eaten by each child. These data were transferred to separate sheets for each child for each of the seven menus, so that a continuous record of the reaction of the child to the menus would be available for the entire period during which she was under observation. Calculated values for the intake of various food constituents were made daily for each child. Data used in these calculations were taken from the standard references on food composition, the compilation of these data published by the department of dietetics, University Hospital,[6] being used for convenience. When acid-base values were not obtainable, they were calculated by the method recommended by Salter, Fulton and Angier.[7]

The report of the White House Conference on Child Health and Protection [2] gives an excellent review of previous studies that have been published on the energy requirements of children of various ages. It includes a critical discussion on the methods that have been used in measuring the intake of food in children, the number of days' intake measured by the various workers and the conditions under which the children ate the food. With all of these points in mind, an evaluation of the conclusions of the studies that have been reported was made. No attempt will be made in this report to restate the principles so clearly laid down in this review. A recent publication by Wait and Roberts [4a] repeats much of this information with regard to studies that have been made of the food required by adolescent girls.

We feel that the conditions under which our children ate their meals are representative of conditions in a home in which those in charge understand the children's dietary needs and the best methods of training the children to eat the necessary foods. Thirty-five balance studies which were conducted for periods of one week each during the course

6. Waller, D. S.: Nutritive Value of Foods, Ann Arbor, Mich., George Wahr, Publisher to the University of Michigan, 1932.

7. Salter, W. T.; Fulton, C., and Angier, F.: Studies in Calcium and Phosphorus Metabolism: XI. The Calculation of Acid-Base Content of the Diet, J. Nutrition **4**:1 (May) 1931.

of our investigations, the results of which will be published later, give us confidence that our calculated figures, at least for protein, calcium and phosphorus, are reasonably accurate, and that our methods of measurement and calculation are dependable.

TABLE 1.—*Intake of Food of Girls from 7 to 13 Years of Age, on a Well-Selected Diet with Extra Helpings of Food Available*

Number of Child*	Age Group, Years	Length of Time, Days	Total Daily Calories	Percentage Distribution of Daily Calories			Calories per Kg.	Protein per Kg., Gm.
				Protein	Fat	Carbohydrates		
1†	6-7	91‡	1,747	14.0	43.1	42.9	75.20	2.63
2†	6-7	192‡	1,631	14.1	43.9	42.0	77.50	2.74
Average 6-7 years....		141	1,689	14.0	43.5	42.4	76.35	2.68
3†	7-8	131‡	1,673	14.1	43.9	42.0	84.69	2.99
4†	7-8	49	1,700	13.9	43.3	42.8	78.56	2.74
5†	7-8	119	1,916	14.4	42.8	42.8	75.62	2.72
6	7-8	147	1,829	14.4	43.0	42.6	71.67	2.57
7	7-8	49	1,788	14.0	41.6	44.4	65.00	2.27
8	7-8	63	1,877	14.5	43.3	42.2	63.17	2.29
Average 7-8-years....		93	1,797	14.2	43.0	42.8	73.12	2.60
9†	8-9	77	1,965	14.6	43.2	42.2	74.40	2.71
10	8-9	80	1,876	14.5	43.0	42.5	64.77	2.36
11	8-9	49	1,996	13.9	43.0	43.1	74.60	2.61
12	8-9	49	2,052	14.0	42.4	43.6	66.28	2.30
Average 8-9 years....		64	1,972	14.2	42.9	42.9	70.00	2.50
13	9-10	35	1,681	14.1	43.6	42.3	63.08	2.22
14	9-10	112	1,887	14.3	43.0	42.7	65.90	2.35
15†	9-10	42	2,222	14.6	42.5	42.8	70.80	2.58
16	9-10	168	1,982	14.4	43.0	42.6	61.49	2.21
17	9-10	98	1,845	14.5	43.8	41.6	66.54	2.41
Average 9-10 years...		91	1,923	14.4	43.2	42.4	65.56	2.35
18	10-11	98	2,072	14.6	42.5	43.0	78.60	2.86
19	10-11	42	2,298	14.1	42.5	43.3	60.10	2.10
20†	10-11	175‡	2,089	14.3	43.4	42.3	66.43	2.40
21	10-11	35	2,111	14.3	42.7	42.7	56.15	2.00
22†	10-11	70	2,130	14.8	42.8	42.4	70.50	2.60
23	10-11	98	1,781	14.1	43.4	42.5	59.94	2.11
Average 10-11 years		86	2,080	14.5	42.9	42.7	65.30	2.34
24	11-12	42	2,436	13.8	43.0	43.2	63.30	2.18
25	11-12	42	2,025	14.4	43.0	42.6	63.20	2.28
26†	11-12	56	2,156	14.4	42.3	43.3	56.70	2.05
27	11-12	28	2,033	14.9	43.1	42.0	48.87	1.81
Average 11-12 years		42	2,162	14.4	42.8	42.8	58.02	2.08
28	12-13	56	2,110	14.6	42.4	43.0	67.28	2.46

* Numbers 4, 5, 9, 19 and 20 were Negresses.
† Discharged at the close of the period. The rest of the children were transferred to other diets.
‡ Seventy days during which food was not weighed intervened in this period.

The children were weighed once a week before breakfast and measured once a month. Normal average heights for age and weights for height and age were calculated by reference to the Woodbury tables for normal healthy white girls.

In this report a child is referred to by number only, a given number in table 2 always referring to the child of that number in table 1, in which all of the children are listed in order of age.

OBSERVATIONS

Physical Condition of the Children.—Seven of the children were shorter for their age on admission than Woodbury allows for girls of short stature. Numbers 13 and 28 were 2 inches (5 cm.) below his lowest normal height for their ages whereas numbers 15, 16, 18, 22 and 23 were between ½ and 1 inch (1.27 and 2.5 cm.) below this level. Numbers 3, 17 and 25 were within the normal range given in the Woodbury tables but were very close to the lowest height for girls of short stature. Numbers 8 and 10 were taller than the normal range for tall girls of their age, whereas numbers 12, 19 and 21 were at the upper level of the normal range for tall girls.

Numbers 2, 3 and 10 were between 7 and 12 per cent below normal weight for their age and height when admitted to the hospital, and numbers 5, 6 and 27 were approximately 7 per cent above the average weight. Numbers 13, 15 and 16 were from 14 to 23 per cent above the average weight.

There was little sickness of the ordinary types during the time we had the children under observation, interruptions of dietary schedules being occasioned chiefly by tonsillectomies and a few cases of measles and scarlet fever. These periods are not included in the number of days recorded in table 1. The figures in this table refer only to the number of days during which each child's intake of food was weighed and calculated.

Number 5 was removed from the dietary group at the end of the period indicated because of suspected tuberculosis.

Distribution of Calories Between Protein, Fat and Carbohydrate.—Regardless of age or of daily caloric intake, a most remarkable uniformity will be seen in table 1 in the distribution of calories between protein, fat and carbohydrate for the long periods of time covered by these observations.

Holt and Fales,[3e] after measuring the intake of food for four days in one hundred six children of both sexes between the ages of 1 and 18 years, recommended that 15 per cent of the calories should come from protein. Their data show a range from 11 to 33 per cent, with 50 per cent of the values falling between 14 and 16 per cent. Our data show an average of 14.3 per cent of the calories from protein, the range being limited to values between 13.8 and 14.9 per cent.

Holt and Fales recommended that 34 per cent of the calories should come from fat. Their data show values varying from 31 to 51 per cent, with 75 per cent between 30 and 40 per cent. In our study, the per cent of total calories coming from protein averaged 43.2, all of the values lying between 41.6 and 43.9 per cent.

These investigators also recommended that 51 per cent of the daily calories should come from carbohydrate, but their measured intakes of food show variations of from 38 to 65 per cent of calories from this source, 75 per cent of the values ranging from 44 to 55 per cent. The average percentage of calories from carbohydrate in our group was 42.6, with all of the values between 41.6 and 44.4 per cent.

We do not offer these findings for the distribution of calories as the only ones indicative of a well selected diet. No doubt there are many well nourished persons consuming food in which there is a smaller proportion of fat and a larger proportion of carbohydrate. All of our children took about a quart of milk each day. Butter was served ad libitum at each meal, and fat was used freely in seasoning foods—all of which helped to increase the possible calories due to fat. The children chose to partake liberally of fat-rich foods. In homes in which practices similar to ours are followed in the planning of menus and in which children eat freely of all of the available foods, we feel that distributions of calories such as are found in our studies are more nearly approached than are those recommended by Holt and Fales.

We also believe that our results show conclusively that when children are fed regularly and when intelligent thought is given to the kind of food offered at meals, without constant fussing and nagging and with the atmosphere at mealtime conducive to eating and enjoying food, children will eat and can be depended on, in general, to judge how much they should eat. This, after all, is the most important practical lesson to be gained from the interesting work of Davis in Chicago.[8] By our own planning, we could not have attained such uniform results over long periods as were secured by allowing freedom in extra helpings as described.

Our data also serve to emphasize the possible errors in conclusions based on measurements of the intake of food over a short time in children whose customary dietary habits are not known. Our studies covered a long enough time to smooth out the fluctuations from day to day which were so conspicuous in the data of Holt and Fales.

Caloric Requirement per Kilogram of Body Weight.—As will be seen by reference to table 1, there was a gradual decrease in caloric intake per kilogram of body weight from between 75 and 80 for the youngest girls to between 55 and 60 for the oldest ones. Our findings for this small number of girls observed for long periods agree rather closely with the recommendations made by Sherman[9] from the compila-

8. Davis, C. M.: Self-Selection of Diet by Newly Weaned Infants, Am. J. Dis. Child. **36**:651 (Oct.) 1928.

9. Sherman, H. C.: The Chemistry of Food and Nutrition, ed. 3, New York, The Macmillan Company, 1926.

tion by Gillett [1] of the most dependable data available up to 1917. We find no justification for Holt and Fales' recommendation of 80 calories per kilogram for girls of 11 and 12 years and of 76 calories per kilogram for those of 9 and 10 years.

On close examination of the individual caloric intakes per kilogram, those for numbers 7, 8, 10, 12, 13, 16, 19, 21, 23 and 27 seem low for their age groups, whereas the values for numbers 3, 15, 18, 22 and 28 seem correspondingly high. Most of these children have been previously discussed because of apparent abnormalities in height. If one refers the actual height of each of these girls to the Woodbury tables for average normal heights for various ages, and then rearranges them into the age groups in which their height would seem to place them, the following changes would be indicated: Number 3 would appear in the 6 year group, numbers 15 and 18 in the 7 year group, number 22 in the 8 year group, numbers 8 and 12 in the 9 year group, numbers 10 and 28 in the 10 year group, number 19 in the 11 year group and number 21 in the 12 year group.

If table 1 is reconstructed in this manner, the average caloric intake for the 6 year group would be 79.1, for the 7 and 8 year groups 73.3; for the 9 and 10 year groups, 64.5, and for the 11 and 12 year groups, 58.1. The discrepancies apparent in table 1, in the orderly decrease in caloric intake per kilogram with increasing age, are largely eliminated.

This may indicate that when a satisfactory diet is available in unlimited amount, the energy intake of children per kilogram of body weight is more directly related to their height-age than to their actual age. Exception to this theory is found in numbers 13, 16 and 23, who were shorter than normal short girls of their ages, but whose caloric intake per kilogram seems normal for their true ages. If the aforementioned theory is warranted by the evidence presented, one might be justified in predicting that the shortness of these three girls was hereditary and not the result of stunting.

The average length of time the children listed in table 1 were given the basal diet was eighty-three days. During this period the average gain in the height was 0.4 inches (1 cm.), with a maximum gain for number 2 of 2.25 inches (5.7 cm.). The average gain in weight was 1.9 pounds (0.8 Kg.), the maximum gain of 6.25 pounds (2.8 Kg.) being made also by number 2. The four girls who were so markedly overweight on admission (numbers 7, 13, 15 and 16) gained respectively 0.5, 1.25, 0.25 and 2.5 pounds (0.22, 0.56, 0.11 and 1.13 Kg.) during the time indicated for each in table 1.

Protein Requirement per Kilogram of Body Weight.—The data presented in table 1 show a gradual decrease in the intake of protein per kilogram of body weight with increasing age, being between 2.5 and

3 Gm. per kilogram for the 6 year group and falling to approximately 2 Gm. per kilogram for the oldest children. However, the discrepancies in orderly decrease that are apparent in the caloric intake per kilogram are likewise seen for the same children in their intake of protein. With the reconstruction of table 1 as previously described to suit the height-age of the girls, the discrepancies disappear. The average protein intake per kilogram for the new 6 year age group becomes 2.8 Gm.; for the girls from 7 to 8 years, 2.6 Gm.; for those from 9 to 11 years, 2.3 Gm., and for those from 11 and 12 years, 2.1 Gm.

Again we found no justification for the Holt and Fales recommendation of 2.9 Gm. to 3 Gm. per kilogram for girls from 6 to 13 years of age—the highest value for the oldest girls. Wait and Roberts [4e] report values averaging from 1.2 to 2 Gm. per kilogram for girls from 8 to 12 years of age and averaging 1.56 Gm. for those of 12 years. The intake of food for each child was measured for seven days. Sherman [9] merely stated that between 10 and 15 per cent of the calories should come from protein, with the diet including approximately a quart of milk a day to insure the quality of the protein. This standard was adequately met by our children.

Amounts of Different Kinds of Food Eaten by the Children.—A general summary was made of the amounts of fruit, vegetables, meat and milk eaten by nine of the girls for the first seven or eight weeks during which they were on the basal diet. The nine girls were selected in order to have each of the seasons represented, because of the seasonal changes in the use of fresh fruits and vegetables. A condensed statement of part of this information is given at the bottom of table 2.

We wish to call attention to the liberal use of vegetables and fruit by these girls, in spite of the fact that they received regularly a quart of milk a day, including that used in cooked food.

Some authorities object to giving children this amount of milk to drink at meals because they believe that it interferes with eating enough other foods. Our experience has convinced us that children with normal appetites regard milk as merely something to drink; they will eat everything in sight and drink the milk, too.

The children rarely asked for extra slices of bread, preferring more meat, potatoes or vegetables. The bread served was whole wheat bread made in the hospital. Ice cream, custard and the few simple puddings that are included in the menus were popular, but second helpings of these desserts were not in such great demand as were extra portions of fruit. Additional servings of breakfast cereal and of milk were often requested.

Amounts of Various Food Constituents Eaten by the Children.—Table 2 gives the average intake of various foodstuffs for the nine aforementioned girls and for the same periods.

When all twenty-eight girls were grouped according to weight instead of age, as in table 1, it was found that there were thirteen between 25 and 30 Kg., six between 30 and 35 Kg. and four between

TABLE 2.—*Average Daily Intake of Various Foods and Food Constituents of Nine Girls (7, 8, 9, 10, 12, 16, 19, 20 and 24) for Periods of from Six to Eleven Weeks After Admission*

	Average	Range	Recommendations of Others
Protein:			
Grams daily	74	63 to 84	
Grams per kilogram	2.4	2.10 to 2.71	
Per cent of total calories	14.2	13.8 to 14.6	10 to 15 [9]
Fat:			
Grams daily	99	89 to 116	
Per cent of total calories	42.8	41.6 to 43.3	
Carbohydrate:			
Grams daily	223	197 to 263	
Per cent of total calories	43.0	42.2 to 44.4	
Calories:			
Total	2,074	1,788 to 2,436	2,200* [1,9]
Per kilogram	66.4	60.1 to 74.4	71.7* [9]
Per inch	39.5	34.2 to 44.6	30 to 49 [4a]
Acid value: cc. N/1	19.0	16 to 24	
Base value: cc. N/1	49.4	39 to 58	
Excess base: cc. N/1	30.4	24 to 36	
Calcium:			
Grams daily	1.39	1.28 to 1.58	1.0 min.[9]
Milligrams per kilogram	44	36 to 51	45.7 min.[10]
Phosphorus:			
Grams daily	1.54	1.34 to 1.75	1.0 min.[9]
Milligrams per kilogram	49	42 to 57	69.0 min.[10]
Iron:			
Milligrams daily	13.9	10.2 to 16.7	
Milligrams per kilogram	0.44	0.37 to 0.53	0.48† [12]
Milligrams per 100 calories	0.66	0.56 to 0.72	0.62† [12] 0.80† [11]

	Average Daily Intake of Certain Foods, Gm.‡	
Raw fruit and vegetables	190	
Cooked fruit and vegetables	250	
Potatoes	140	
Milk, total, all purposes	985	Range 940 to 1,110
Meat, fish, liver, poultry	65	
Egg, all purposes	45	
Total bread, cereal, rice, etc.	170	
Butter, as spread	30	

* This figure is an average made from individual calculations for each of the nine children from the Gillett and Sherman recommendations.

† Recommendations are made from experiments on balance in preschool children. No data were available for older children.

‡ Other types of food included in the week's menus, but not listed here.

35 and 40 Kg. In each of the groups the average caloric intake per inch (2.5 cm.) of height was 38.07, 39.7 and 39.4, respectively. Wait and Roberts,[4a] said that, according to their observations, from 39 to 40 calories per inch of height gives a rough approximation of a girl's caloric needs. Our data seem to confirm this tentative conclusion.

Our data and theirs, however, show rather wide individual variations from average values—our range of variation for all twenty-three children cited being from 34 to 45 calories. The nine children whose intake of food is given in table 2 show an average of 39.5 calories per inch of height, with a range of from 34.2 to 44.6. There seems to be no need of further discussion of the figures representing the protein, fat, carbohydrate or caloric intake of the girls; they conform so closely to the general averages for the entire group.

There are no standards available for the desirable acid-base value of the diet. We submit the average figures in table 2, which are typical of the entire group, not as a standard, but as a contribution in this field. The acid value in our basal diet, as will be seen, bears the ratio to the base value of 2 to 5. It seems to be rather generally accepted that a normal, well balanced diet should be base-forming.

In regard to calcium and phosphorus, Sherman [9] recommends for growing children at least 1 Gm. of each a day, including that from approximately 750 Gm. of milk. This standard was very adequately met by all of the children in our group, as will be seen in the representative figures given in table 2. Wang and her colleagues,[10] as a result of studies of balance in undernourished girls of school age, recommended a minimum of 49 mg. of calcium and 69 mg. of phosphorus per kilogram a day for a girl, aged 8 years, who weighs 20 Kg. Our data for calcium meet this standard, but the intake of phosphorus, in spite of being 50 per cent higher than Sherman's recommendation, is considerably below that of Wang. Perhaps this can be explained on the basis that the children in Wang's studies were undernourished and might, conceivably, require a proportionately larger amount of phosphorus than of calcium. Most of our group showed no evidences of being undernourished. All of our girls of 8 years weighed more than 20 Kg. Studies of balance in selected children in our group (to be reported later) have indicated general positive retentions of calcium and phosphorus.

No reports are available of studies of iron balance for children of school age. The recommendations of Rose and her co-workers [11] and of Leichsenring and Flor [12] are based on studies of balance made in preschool children. Both groups have reported considerable variation in the figures for the intake of iron which were obtained by analysis of aliquot portions of the food eaten and in those which were obtained

10. Wang, C. C.; Kern, R., and Kaucher, M. S.: Minimum Requirement of Calcium and Phosphorus in Children, Am. J. Dis. Child. **39**:768 (April) 1930.

11. Rose, M. S.; Vahlteich, E. McC.; Robb, E., and Bloomfield, E. M.: Iron Requirement in Early Childhood, J. Nutrition **3**:229, 1930.

12. Leichsenring, J. M., and Flor, I. H.: The Iron Requirement of the Pre-School Child, J. Nutrition **5**:141, 1932.

by calculations, the latter figures being as much as 30 per cent too high. If the recommendations of the aforementioned workers are applicable to older children, the intake of iron of our children was too low, especially since our calculated figures are doubtless high. However, in spite of the removal of from 40 to 50 cc. of blood for analysis once a month, from January, 1931, to June, 1932 (this was repeated eight or ten times in some of the girls), the girls in general remained free from anemia. Meat and eggs were served liberally, as will be seen in table 2, and liver was served once a week. A few of the children were anemic when admitted and were given iron medication by the physicians in charge.

SUMMARY

1. Quantitative records of the intake of food of twenty-eight normal girls from 6 to 13 years of age were collected for periods of time varying from twenty-eight to one hundred and ninety-two consecutive days on a uniform type of diet suitable for growing children. The general physical condition of the children, the policies followed in feeding them and the methods of calculation are described.

2. The average distribution of calories for the group was 14.3 per cent from protein, 43.2 per cent from fat and 42.6 per cent from carbohydrate. All of the individual variations were within from 3 to 4 per cent of the average values.

3. The caloric intake per kilogram of body weight was between 75 and 80 for the girls from 6 to 8 years of age, gradually dropping to between 55 and 60 for those of 12 years; this confirms the recommendations of Sherman.

4. The intake of protein per kilogram of body weight was between 2.5 and 3 for the girls from 6 to 8 years old, with a gradual decrease to between 2.3 and 1.8 for the girls of 12 years.

5. Calculated acid-base values of the diet used showed a ratio of 2 parts of available acid to 5 parts of available base.

6. The intake of calcium and phosphorus for the group met the standard set by Sherman, but the intake of phosphorus per kilogram of body weight fell below the recommendation of Wang.

7. The calculated values for the intake of iron reported in this study are probably too high, the actual intake, therefore, being below the recommendations of Rose and Leichsenring for preschool children, although the efficiency of utilization was doubtless higher in our children, owing to the amount of meat, liver and egg included regularly in the diet.

The nursing and medical staff of the division of social hygiene, University Hospital, and the staff of the department of dietetics assisted in this study.

A COMPARISON OF THE SCHICK AND THE DICK TEST IN MOTHERS AND NEW-BORN INFANTS

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It has been noted by several observers that the Schick reaction is unreliable in new-born infants. Infants, born of mothers who gave a positive reaction to the Schick test, who have no demonstrable antitoxin in their blood fail in a large percentage of instances to give a positive reaction to the Schick test.

Von Groer and Kassowitz [1] found that only seven infants of twenty-three who had been shown to have no antitoxin in their cord blood gave positive reactions when tested intradermally. Thus, 70 per cent failed to react. In Ruh and McClelland's [2] series of twenty-four infants born of mothers giving positive reactions to the Schick test, four, or 17 per cent, gave a negative skin test. In Kuttner and Ratner's [3] eleven cases, seven, or 64 per cent, failed to react.

It is obvious that the number of infants observed by these authors is too small to warrant any conclusions as to the percentage who fail to give a positive reaction to the Schick test in the absence of antitoxin. Cooke and Sharma [4] have recently published two much longer series: In the first, consisting of eighty-four infants born of mothers who gave positive reactions to the Schick test, fifty-one, or 60 per cent, gave positive reactions, while thirty-three, or 40 per cent, failed to react. In the second series, of one hundred infants born of mothers giving positive reactions to the Schick test, sixty-four reacted positively, leaving 36 per cent who failed to react.

Aided by a grant from the Helen Hartley Jenkins Fund and a grant from the Henry Strong Denison Fund.

1. von Groer, F., and Kassowitz: Ueber das Verhalten des normalen Diphtherien-Antitoxins bei Müttern und Neugeborenen, Ztschr. f. Immunitätsforsch. u. exper. Therap. **23**:108, 1915.

2. Ruh, H. O., and McClelland, J. E.: Comparison of Diphtheria Immunity in the Mother and in the New-Born, Am. J. Dis. Child. **25**:59 (Jan.) 1923.

3. Kuttner, A., and Ratner, B.: The Importance of Colostrum to the New-Born Infant, Am. J. Dis. Child. **25**:413 (June) 1923.

4. Cooke, J. V., and Sharma, B. M.: Schick Test in the Newly Born, Am. J. Dis. Child. **44**:40 (July) 1932.

The discrepancy in the case of the Dick reaction in mothers and new-born infants is even greater. In Cooke's [5] series of fifty-three mothers who give a positive reaction to the smallest doses of streptococcus toxin (2SKT), only two infants reacted positively to the same dose. The failure of new-born infants, who lack scarlet fever antitoxin, to give positive reactions to the Dick tests is interpreted by Cooke as indicating that the Dick reaction is not a simple toxin-antitoxin reaction. He thinks that it is necessary for a person to come in contact with the scarlet fever streptococcus, and become sensitized to its products, before a positive reaction to the Dick test can be obtained. The new-born infant fails to react because it has had no opportunity to become infected with the specific organism. Since the failure of new-born infants to give positive reactions occurs also in the case of the Schick reaction, in which the question of sensitization does not enter, it was thought of interest to study the Schick and Dick reactions in parallel in mothers and new-born infants.

PROCEDURE

Schick and Dick tests were made on patients in the obstetric departments of the Johns Hopkins and Sinai Hospitals. Mothers and infants were given injections at the same time with Schick and Dick material. The infants ranged from 3 to 7 days of age. One arm was used for the Schick test and the other for the Dick test. Heated diphtheria toxin was used as the control for the Schick test. No control was used for the Dick test, since the streptococcus toxin is not readily destroyed by heat; the broth constituents were present in the control for the Schick test.

Schick Test.—The material used for the test and the control was sent us by the courtesy of the research laboratories of the New York City Health Department. The same quantity, 0.1 cc., was injected in corresponding hours. A positive reaction in adults produced an area of induration, often 3 cm. in diameter, accompanied by vesiculation and erythema. In infants, in the few cases in which a positive reaction was obtained, the reaction was always very much less marked than in the mothers. The erythematous area never exceeded 1 cm. in size, the induration was extremely slight, and vesiculation was never observed. The reactions faded more rapidly than those in the mothers and, with one exception, did not leave pigmented areas.

Dick Test.—The toxin used was obtained from Parke, Davis & Co.; 0.1 cc. was injected into the mothers and infants, intradermally, in the skin of the forearm. Readings were made in twenty-four hours. A positive reaction in adults produced areas of erythema and induration frequently from 4 to 5 cm. in diameter. In no instance was a positive reaction obtained in an infant.

Results.—Two hundred and fifteen mothers and infants were tested. Of these, one hundred mothers, or 46.5 per cent, gave a positive reac-

5. Cooke, J. V.: The Relation Between Antitoxin in the Blood and Skin Sensitivity in New-Born Infants and in Their Mothers, Am. J. Dis. Child. **34**:969 (Dec.) 1927.

tion to the Schick test, and forty-six, or 21.8 per cent, to the Dick test. Of the one hundred mothers who gave a positive reaction to the Schick tests, only three showed a positive reaction to the Dick test.

Of the one hundred infants born of mothers giving a positive reaction to the Schick test, only six gave a positive reaction. Of the forty-six infants born of mothers giving a positive reaction to the Dick test, none gave a positive reaction to the Dick test. In this series, therefore, 94 per cent of the infants without any diphtheria antitoxin in their blood failed to react to the intradermal injection of diphtheria toxin, and 100 per cent of the infants without any streptococcus antitoxin in their blood failed to react to the intradermal injection of streptococcus toxin.

As already mentioned, the six positive reactions to the Schick test obtained in the infants were much less marked than those obtained in

Reactions to the Schick and Dick Tests in Mothers and New-Born Infants

	Mothers	Per Cent	Infants	Per Cent
Schick positive	100	46.5	6	2.7
Schick negative	115	55.4	209	97.3
Total	215	100.0	215	100.0
Dick positive	46	21.3	0	0.0
Dick negative	169	78.2	215	100.0
Total	215	100.0	215	100.0

the mothers. It is of interest that of the six positive reactions to the Schick test obtained in infants, three occurred in infants whose mothers reacted positively to both Schick and Dick tests. These three infants were, therefore, able to react to the diphtheria toxin, but not to the streptococcus toxin.

The failure to obtain any positive Dick reactions in the infants can be interpreted in various ways. The finding that the three infants whose mothers showed positive reactions to both tests reacted to the Schick test, but not to the Dick test, might simply indicate that the diphtheria toxin is more potent than the streptococcus toxin. There can be no doubt that the threshold of reactivity of the infant's skin is much higher than that of the adult's, and it may be that the diphtheria toxin, in the doses used, is occasionally sufficiently active to produce a reaction, whereas the streptococcus toxin is usually too weak.

Cooke interprets the failure of the new-born infant to react to the Dick test as an indication that the Dick test is allergic, rather than a simple toxin-antitoxin reaction. He finds that he is able to change the

reaction to the Dick test in infants from negative to positive by transfusing with blood from donors who react positively to the Dick test.

It was thought that if a positive Dick test depended on sensitization, it might be possible to transfer the reaction by the method of Prausnitz and Küstner. It has been shown by T. Nelson Carey, in a report to be published shortly, that the new-born infant is capable of receiving passive transfer with antigens such as ragweed and egg white.

EXPERIMENTATION

Serum was obtained from an adult who reacted positively both to Schick and Dick tests, and 0.1 cc. was injected intradermally into four sites on the forearms of ten infants, less than 4 months of age, who had failed to react to either the Schick or the Dick test. Twenty-four hours later diphtheria toxin, heated diphtheria toxin, and streptococcus toxin, as used in the Schick and Dick tests, were injected into three of the sites, the fourth being left as a control. Not a single positive reaction was obtained.

HISTOLOGY

Any one who has tried to make comparative intradermal tests on adults and young infants realizes that it is much more difficult to inject a solution into the skin of the latter than into that of adults. It is difficult not only to insert the needle into the infant's skin, but when the needle is in place, a great deal of pressure is necessary to inject even 0.1 cc. of a solution. The wheal that results is usually not so large and has a tendency to disappear more rapidly than in adults. This would lead one to suppose that there is a difference in anatomic structure in the different age groups. Since no descriptions of the skin of the forearm, either in infants or adults, could be found in the literature, specimens of skin were removed at autopsy from stillborn babies and young adults. The specimens were sectioned, and stained with hematoxylin and eosin and Mallory's connective tissue stain. In the infant, the epidermal layers are thicker than in the adult and contain cells with well defined nuclei which take a deep stain. In the corium, the papillae of the infant are smaller and not so well defined. The bundles of connective tissue are very closely woven in the adult skin and relatively few nuclei are visible in comparison with those seen in the infant's skin. Whether or not these anatomic differences are significant in respect to the ability of the skin to react to the toxins of diphtheria or scarlet fever, it is impossible to say.

COMMENT

Since it has been shown by various observers that the cord blood of infants born of mothers who give a positive Dick reaction contains no streptococcus antitoxin, and, similarly, that infants born of mothers

who give a positive Schick reaction have no diphtheria antitoxin in their circulation, it seems possible that the failure of new-born infants to react consistently to the Dick and Schick tests is due to some difference in the epidermal layers of the skin at birth. Histologic examination of the skin of new-born infants and of adults shows that the epidermis of the former is thicker, and that the papillae of the corium are less well defined. It may be that the failure of the infant to react is due merely to the fact that the toxins, owing to the density of the epidermal layers, are not introduced superficially enough to produce a reaction that can be read.

Cooke and Sharma [4] consider this argument invalid, because they were able to show that a direct relationship exists between the degree of sensitivity of the mother and the ability of the infant to react to the Schick test. Thus, in those cases of the series in which the mother's reaction to the Schick test was strongly positive, only 12 per cent of the infants failed to react. However, Cooke himself has shown that the same thing is true in the case of the Dick test. He showed that in those cases in which the mother reacts to the smallest dose of streptococcus toxin (2 STD), the greatest number of positive reactions to the Dick test were obtained in the infants. Whereas, if the mother has a positive reaction only to 20 or 50 STD, indicating that the mother had a certain amount of circulating streptococcus antitoxin, the number of positive Dick tests obtained in the infants was very much smaller. These authors agree with other observers that when a positive reaction to the Schick test is obtained in an infant, it is smaller and more transient than that obtained in adults. They attribute this phenomenon to the fact that embryonic tissue has been shown by Wadsworth and Hoppe [6] to have the power of neutralizing diphtheria antitoxin, which can probably be best interpreted as a nonspecific property of rapidly growing tissue. It has been shown by Friedberger and Heim [7] that the skin of new-born infants is refractory to injections of eel serum, a substance which is primarily toxic for older children and adults. Adelsberger [8] found the skin of new-born infants as compared to that of older infants much less susceptible to chemical irritants, such as iodoform, quinine and turpentine.

Cooke and Sharma have had the same experience as other workers, that it is difficult to produce satisfactory intradermal injections in new-

6. Wadsworth, A., and Hoppe, E. N.: The Neutralization or Destruction of Diphtheria Toxin by Tissue, J. Exper. Med. **53**:821 (June) 1931.

7. Friedberger, E., and Heim, F.: Zur Deutung der negativen Schickschen Reaktion insbesondere bei Saüglingen, Deutsche med. Wchnschr. **55**:132 (Jan. 25) 1929.

8. Adelsberger, L.: Das Verhalten der kindlichen Haut gegenüber verschiedenen Reizen, Ztschr. f. Kinderh. **43**:373, 1927.

born infants. It seems likely that this finding may be related to differences in the histology of the skin. It is a well-known fact that even in older children who are known to show positive reactions, unless a truly intradermal injection is made, no reaction will be obtained.

The differences in the percentages of infants without antitoxin in their blood who fail to react to the Schick test in the Cooke and Sharma series (40 per cent and 36 per cent) as compared with 94 per cent in ours are difficult to explain, especially as we were using the same toxin, obtained from the New York City Health Department, as was used in Cooke's first series.

The occasional positive reactions obtained with the Schick test in new-born infants might perhaps be explained by the greater potency of diphtheria toxin as compared with streptococcus toxin. It was thought that if, as Cooke maintains, sensitization to the streptococcus is necessary before a positive reaction to the Dick test can be obtained, it should be possible to induce a positive reaction to the Dick test in infants by the method of passive transfer. These attempts were, however, entirely negative. At the present time, it seems probable that the failure of new-born infants, in most instances, to react to both the Schick and the Dick test in the absence of any demonstrable circulating antitoxin is based on a similar mechanism. Since the question of sensitization does not enter into the Schick test, which is a true toxin-antitoxin reaction, it seems advisable to look for some other explanation which will hold for both tests.

CONCLUSIONS

1. In accord with the observations of previous workers, the Schick and Dick tests have been found unreliable in new-born infants.

2. No adequate explanation has been found for the discrepancies observed between the reactions of adults and new-born infants with either of these tests.

3. It seems possible that the failure of new-born infants to react to both the Schick and the Dick test in the absence of antitoxin may be related to a nonspecific property of the skin of the new-born, which is known to be refractory to substances of primary toxicity such as eel serum and chemical irritants.

DOES A CHANGE IN THE SCHICK REACTION USUALLY FOLLOW REMOVAL OF THE TONSILS AND ADENOIDS?

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Tomlin,[1] in 1916, and many other physicians since then have advanced the opinion that diphtheria develops much less frequently in children whose tonsils and adenoids have been removed. Collins [2] and Syndenstricker made a statistical study on school children and found that the incidence of diphtheria in children whose tonsils had been removed was 1.4 per thousand as compared with 4.6 per thousand in children with the tonsils present. The lessened susceptibility to clinical diphtheria of children on whom tonsillectomy has been performed has been attributed either to the removal of tissues which are especially subject to infection or to the fact that these children come in contact with diphtheria bacilli and that a clinically unrecognizable infection develops during the ten to twelve days that the mucous membrane of their throats is in the process of healing. It is believed that sufficient toxin is developed and absorbed to stimulate the production of antitoxin.

The discovery by Schick of a skin test for antitoxic immunity has led both him and a number of other investigators to use the test in an attempt to determine whether antitoxic immunity develops more frequently in children after tonsillectomy than in those who have never had this operation.

The first use of the Schick test to determine the development of immunity was, so far as we know, by Traina [3] in 1923. He did preliminary Schick tests on 100 children who were to have their tonsils removed. Forty of the children gave a positive reaction. A retest made from thirty to forty days after the operation showed a negative reaction

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From the Pediatric Service of Fifth Avenue Hospital.

Drs. Oscar Rimson, David Nemhauser and Hazel M. Hatfield; Miss Leah Alper, Health Department Technician, and Miss G. Matthews, Charge Nurse of the Pediatric Service of Fifth Avenue Hospital, assisted in this work.

1. Tomlin: Indianapolis M. J. **19**:325 (Aug.) 1916.

2. Collins, S. D.: Epidemiological and Statistical Study of Tonsillitis Including Related Throat Conditions, U. S. Pub. Health Bull. no. 175, 1927.

3. Traina, S.: Schick Test in Children with Adenoids, Policlinico (sez. prat.) **30**:1617 (Dec.) 1923.

in sixteen of the forty children, or 40 per cent. Ferreri and Traina believed that a greater proportion of the children would have given a negative reaction if there had been a longer interval between the operation and the retest. Cultures taken from the throats of many of the children showed either virulent or nonvirulent diphtheria bacilli in from 80 to 90 per cent of the cases. Cultures taken from the throats of seventy carriers more than one month later were largely negative. Ferreri and Traina believed that the development of antitoxin was due to the absorption of diphtheria toxin by the tissues exposed by the removal of the tonsils and adenoids. They used ten children as controls. The positive Schick reaction of these children did not change in the same period.

Six years later, without knowledge of the results obtained by Ferreri and Traina, Schick and Topper [4a] resolved to use the Schick test on a considerable number of children who were to have their tonsils removed and to repeat the test six months later. At first they reported on 100 children, and later [4b] on 151, who gave a positive reaction before tonsillectomy. The children were retested six months later. During the interval 80 per cent of the children gave negative reactions. Unfortunately, in their study no children living under similar conditions who did not have their tonsils removed were tested and later retested. The giving of the Schick test itself is known to cause the development in a small percentage of children of enough antitoxin to change a positive reaction to a negative one. These interesting results, from which one infers that tonsillectomy is nearly as effective as injections of toxin-antitoxin or toxoid, stimulated others to repeat the investigation in other communities. One study was undertaken by Geddie [5] of Rochester on school children. Four hundred and eleven children who had undergone neither active immunization nor tonsillectomy were tested. Fifty-six, or 13.6 per cent, gave a negative reaction. Ninety-six children who had undergone tonsillectomy more than six months previously were tested. Twenty, or 20.8 per cent, gave negative reactions. Of 241 children who had received toxoid or toxin-antitoxin but who had not had their tonsils removed, 185, or 76.6 per cent, gave negative reactions, and, finally, of 135 children who had received toxin-antitoxin or toxoid and in addition had had their tonsils removed more than six months previously, 101, or 80.8 per cent, gave negative reactions. These results are arranged in table 1. Geddie, in conclusion, states that in his opinion tonsillectomy has little effect on the development of humoral immunity against diphtheria.

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4. Schick, B., and Topper, A.: (*a*) Effect of Tonsillectomy and of Adenoidectomy on Diphtheria Immunity, Am. J. Dis. Child. **38**:929 (Nov.) 1929; (*b*) Ann. de méd. **29**:628, 1931.

5. Geddie, K. B.: Effect of Tonsillectomy and Adenoidectomy on Diphtheria; Persistently Positive Schick Tests in Small Community, Am. J. Dis. Child. **40**: 1032 (Nov.) 1930.

Burton and Balmain [6] made an exhaustive study on 492 children on whom no tonsillectomy had been performed and on 192 on whom tonsillectomy had been performed, the results of which are shown in table 2. The results of this study also indicate that previous tonsillectomy has but little influence on the production of immunity to diphtheria in children living in a residential, nonrural and noncongested area.

Dudley [7] studied the Schick reaction in school children who had been tonsillectomized before they entered school. They were tested on entry, and others were tested after they had been in school for some time. Children on whom no tonsillectomy had been performed were also

TABLE 1.—*Geddie's Results*

Type of Subject	Number of Children Tested	Number Giving Negative Reactions	Percentage of Negative Reactions
No immunization, no tonsillectomy	411	56	13.6
No immunization, tonsillectomy more than 6 months previously	96	20	20.8
Toxoid or toxin-antitoxin, no tonsillectomy	241	185	76.7
Toxoid or toxin-antitoxin and tonsillectomy more than 6 months previously	125	101	80.8

TABLE 2

Schick Reaction	No Tonsillectomy (492 Children)		Previous Tonsillectomy (192 Children)	
	Number	Per Cent	Number	Per Cent
Positive	383	77.8	146	76.1
Negative	109	22.2	46	23.9

tested. He found that the longer the children remained in school the greater was the percentage of those giving a negative reaction, and that those who entered school after being tonsillectomized had a larger percentage of negative reactions than the others, namely 37 per cent as compared with 14 per cent of those on whom tonsillectomy had not been performed. He believed that removal of the tonsils has no immunizing effect unless diphtheria bacilli are present in the throat.

Wheeler, Doull and Frost [8] tested 710 Baltimore school children whom they classified according to age and the condition of the tonsils. There were 292 children, aged from 6 to 13, with normal tonsils; 158 of these gave a positive Schick reaction and 134, or 45 per cent, a negative one. There were also 328 children, aged from 5 to 13, with enlarged tonsils; 171 of these gave a positive reaction and 157, or 48 per cent, a negative one. Ninety children of the same ages had had their tonsils removed. Of these, 44 gave a positive reaction and 46, or

6. Burton, A. H. G., and Balmain, A. R.: Lancet **2**:1401 (Dec. 26) 1931.

7. Dudley, S. F.: Lancet **2**:1398 (Dec. 26) 1931.

8. Wheeler, R. E.; Doull, J. A., and Frost, W. A.: Am. J. Hyg. **14**:555 (Nov.) 1931.

51 per cent, a negative reaction. The percentage of negative reactions was therefore only slightly lower in those retaining their tonsils than in those on whom tonsillectomy had been performed. The difference was too small to be significant.

As is seen from a review of the articles mentioned, there is quite a variation in the findings of the different authors. Some of them explained the difference in results by pointing out that rural and urban communities cannot be compared because the rate of diphtheria carriers is higher in big cities than in the country. It was thought that a high rate of carriers might be responsible for an increase in the percentage of those who had acquired a natural immunization. Therefore we thought that the clientele of the Fifth Avenue Hospital, which is five blocks from Mount Sinai Hospital, where Dr. Schick's work was done, and which

TABLE 3.—*Frequency of Positive Schick Reactions in Total Group.*

Type of Subjects	Total Number	Number Giving Positive Reactions	Percentage of Positive Reactions
Subjects selected for tonsillectomy	492	150	30
Controls	875	320	36

is on the same avenue and draws its patients from approximately the same social groups, would furnish ideal material for studies the results of which might settle the controversy. We also thought that the tests should be repeated not only on tonsillectomized children but also on a group of controls of equal number.

ORIGINAL EXPERIMENTS

We started the investigation on Aug. 10, 1931, and finished it on Oct. 8, 1932. During this period 492 patients had their tonsils and adenoids removed in Fifth Avenue Hospital. Most of the patients were Puerto-Rican immigrants. All the children were submitted to the Schick test before operation, and a group of them were also tested for the presence of diphtheria-like bacilli in cultures taken from the nose and throat. Those who gave a positive Schick reaction were retested six months following the operation or later. In some cases tests of cultures taken from the nose and throat were repeated. The families of the children tested belonged to a very low social group, and so many of them moved during the six months that only a small proportion of the children who had given positive reactions could be found for the purpose of retesting. For controls we used 875 children who were admitted to the wards during the same period. From these children we selected those who gave a positive reaction to the Schick test. Six months later we retested a number of those who had given positive reactions, eliminating those on whom tonsillectomy had been performed or who had been immunized to diphtheria during the six months between the two Schick tests.

As is seen from table 3, the frequency of positive Schick reactions in the control group and in the group of children selected for tonsillectomy was about the same, i.e., 30 to 36 per cent.

TABLE 4.—*Frequency of Positive Schick Reactions in Controls and in Children Selected for Tonsillectomy With and Without Active Immunization* *

	0-1 Year†				1-2 Years				2-4 Years				4-6 Years				6-8 Years				8-10 Years				10-12 Years			
	Total Number	Negative Reaction	Positive Reaction	Positive, per Cent of Total	Total Number	Negative Reaction	Positive Reaction	Positive, per Cent of Total	Total Number	Negative Reaction	Positive Reaction	Positive, per Cent of Total	Total Number	Negative Reaction	Positive Reaction	Positive, per Cent of Total	Total Number	Negative Reaction	Positive Reaction	Positive, per Cent of Total	Total Number	Negative Reaction	Positive Reaction	Positive, per Cent of Total	Total Number	Negative Reaction	Positive Reaction	Positive, per Cent of Total
Controls, no immunization	98	51	47	48	64	25	39	61	80	34	46	57	58	31	27	47	47	29	18	38	40	32	8	20	50	33	17	34
Children selected for tonsillectomy, no immunization	..	..	..	..	3	1	2	66	35	16	19	54	37	20	17	46	37	20	17	46	21	13	8	38	21	16	5	24
Total, no immunization	98	51	47	48	67	26	41	61	115	50	65	56	95	51	44	46	84	49	35	41	61	45	16	26	71	49	22	31
Standard percentage for city children	..	..	..	15	..	..	..	60	..	..	..	45	..	..	..	40	..	..	..	35	..	..	..	30	..	..	..	21
Standard percentage for country children	..	..	..	40	..	..	..	80	..	..	..	70	..	..	..	60	..	..	..	55	..	..	..	55	..	..	..	50
Controls, immunization	2	2	0	0	22	17	5	23	38	21	17	45	43	29	14	32	38	27	11	29	25	13	12	48	38	28	10	26
Children selected for tonsillectomy, immunization	..	..	..	..	5	2	3	60	66	51	15	23	61	45	16	26	48	32	16	33	16	9	7	44	23	17	5	21
Total, immunization	2	2	0	0	27	19	8	29	104	72	32	31	103	73	30	29	86	59	27	31	41	22	19	46	61	45	15	25

* The figures are omitted for twenty-two subjects who had had no immunization but who had had diphtheria, six of whom showed positive reactions; also for twenty subjects who had had both immunization and diphtheria, eight of whom still gave positive reactions.

† Many of these children were passively immune.

Table 4 shows the frequency of positive Schick reactions in subjects tabulated according to age and according to whether they received toxin-antitoxin at least six months prior to the Schick test. The immunized children show a lower incidence of positive reactions to the Schick test except the group of those aged from 8 to 10. However, more immunized children show positive reactions than one would except. The lack of a more marked difference between the two groups may be explained by the fact that the parents may have given erroneous histories in some cases concerning immunization to diphtheria. The figures obtained by us for subjects who were not immunized compared with the standard figures from

TABLE 5.—*Frequency of Positive Schick Reactions in Controls Changing to Negative Reactions Within Six Months* *

	No Diphtheria, No Toxin-Antitoxin				No Diphtheria, Toxin-Antitoxin Given				Total Number of Cases			
		Schick				Schick				Schick		
Type of Subjects	Total Number	Positive	Negative	Per Cent Negative	Total Number	Positive	Negative	Per Cent Negative	Total Number	Positive	Negative	Per Cent Negative
Controls, no tonsillectomy	31	25	6	19	12	8	4	33	43	37	10	23
Controls, tonsillectomy some time before first Schick test	7	6	1	14	6	1	5	83	13	7	6	46

* As there were very few subjects who had had diphtheria and who had also been immunized, or who had had diphtheria alone, they were not considered in this table.

TABLE 6.—*Comparison of Schick Reactions in Tonsillectomized and Control Children Retested About Six Months After Showing Positive Reactions* *

	No Diphtheria, No Toxin-Antitoxin				No Diphtheria, Toxin-Antitoxin Given				Total Number of Cases			
		Schick				Schick				Schick		
Type of Subjects	Total Number	Positive	Negative	Per Cent Negative	Total Number	Positive	Negative	Per Cent Negative	Total Number	Positive	Negative	Per Cent Negative
Tonsillectomized	25	21	4	16	21	17	4	19	46	38	8	18
Controls, no tonsillectomy	31	25	6	19	12	8	4	33	47	37	10	21

* In nine children on whom tonsillectomy had been performed and in six controls, all of whom were retested from three to five months after the first test, the results were unchanged and are not included in this table.

Park's "Pathogenic Micro-Organisms" [9] show that the percentages of the positive reactions in our subjects were midway between those for city and for country children. This may be explained by the fact that our subjects were mostly Puerto-Rican immigrants who had lived in the city for a short time only. The controls and the children selected for tonsillectomy do not show an appreciable difference in the frequency of positive Schick reactions. This is important, because it may be assumed that the controls are about the same type of subjects as the children selected for tonsillectomy.

9. Park, W. H.; Williams, A. W., and Krumwiede, C.: Pathogenic Micro-Organisms: A Practical Manual for Students, Physicians and Health Officers, ed. 10, Philadelphia, Lea & Febiger, 1933.

Table 5 shows the frequency of positive Schick reactions changing to negative ones in different types of controls within six months. We subdivided the controls into two main groups: those on whom tonsillectomy had never been performed (the majority of cases) and those on whom tonsillectomy had been performed some time before the first positive reaction. There were many fewer cases in the latter group than in the former. From these very few cases one receives the impression that tonsillectomized children give a negative Schick reaction more readily than do nontonsillectomized ones.

We eliminated from both the tonsillectomized and control groups the following subjects: (1) those who had had diphtheria or toxin-antitoxin against diphtheria within six months prior to the first tests, and (2) those who had had diphtheria or active immunization within the six months between the first tests and the retests.

The tests were made and read by one of our doctors or by Miss Alper, a technician of the Bureau of Laboratories of the Department of Health of New York City. The Schick tests were read in most cases within from four to five days after the test was given. Some of the early tests were read after forty-eight hours. Each test was checked with a control test made with heated diphtheria toxin. The material for the tests was obtained from the Department of Health

TABLE 7.—*Frequency of Diphtheria Carriers*

	First Tests and Cultures			Cultures and Retests 6 Months Later		
Type of Subject	Total Number	Positive Cultures	Percentage of Positive Cultures	Total Number	Positive Cultures	Percentage of Positive Cultures
Tonsillectomized.....	378	21	5.5	74	4	5.4
Control.....	875	..	...	82	5	6

of New York City. We called every reaction which was less than 5 mm. in diameter negative.

The subjects who originally gave positive reactions and who were retested six months later were originally subdivided in four groups:

1. Those who had never had diphtheria and had never had toxin-antitoxin or toxoid.

2. Those who had not been immunized but who had had diphtheria more than six months prior to the first test. (As there were only two cases of this nature we eliminated them.)

3. Those who had not had diphtheria but who had been immunized more than six months prior to the first test.

4. Those who had had diphtheria and who had been immunized more than six months before the first test. (Because there was only one case of this nature we disregarded it.)

Practically all the subjects fall in categories 1 and 3. One can see that more positive reactions turned negative in the controls during the six month period than in the tonsillectomized children. One can also note that the frequency of negative reactions is higher in the children who were treated with toxin-antitoxin at some time in the past.

So far as carriers are concerned, all the cultures of the controls were negative at the beginning of the six month period. In 378 of the children selected for tonsillectomy two cultures were taken from the nose and throat at the time of the

first test. Twenty-one of these, or 5.5 per cent, showed diphtheria-like bacilli. At the end of the six month period cultures taken again from the nose and throat of 82 controls were examined. Five children, or 6 per cent, were found to be carriers. Of the 74 children who were tonsillectomized and reexamined, 4, or 5.4 per cent, had positive nose or positive throat cultures or both. Therefore the higher percentage of negative Schick reactions among the controls cannot be explained on the basis of the more frequent occurrence of carriers among them.

We examined the virulence of only two of the thirty positive cultures. Both these cultures contained avirulent diphtheria bacilli. Of the thirty positive cultures only one belonged to a child who had shown a positive culture at both the beginning and the end of the six month period.

There are two explanations for the more frequent occurrence of diphtheria-like bacilli in the children selected for tonsillectomy than in the controls at the beginning of the six-month period: 1. The controls were hospital patients and cultures taken from the nose and throat were negative for all at admission; otherwise they could not have been admitted to the wards. 2. In the children selected for tonsillectomy two cultures from the nose and throat were taken at the time of the first test, one a few hours before operation and the other about eighteen hours after operation. Of twenty-one positive cultures, seventeen were positive only before, two only after, and two both before and after, operation.

We tried to find out whether the size of the reaction to the Schick test diminished more or less frequently in the tonsillectomized children than in the controls. We considered only differences greater than 5 mm. in diameter. We found that 15 per cent of the tonsillectomized children and 18 per cent of the controls showed a diminishing of the positive reaction when they were retested six months after the first test. For the purpose of comparison we also estimated the percentage of cases in which the second Schick test produced a reaction of larger diameter than that produced by the first. There was an increase in the size of the wheal in 35 per cent of the tonsillectomized children and in 20.5 per cent of the controls.

SUMMARY

Forty-six children who had given positive reactions to the Schick test before tonsillectomy were retested by us about six months after the operation. Eighteen per cent of them gave negative reactions.

Of the forty-seven nontonsillectomized controls on whom tonsillectomy had not been performed who gave positive reactions to the Schick test, 21 per cent gave negative reactions after about six months.

All the subjects came from congested urban districts and were mostly Puerto-Rican immigrants.

The carrier rate was not higher in the controls than in the tonsillectomized children.

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REACTIONS OF PATIENTS WITH INFANTILE PARALYSIS TO AUTONOMIC DRUGS

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In the prepoliomyelitic stage of infantile paralysis, a history of disturbance in the gastro-intestinal motility has repeatedly been obtained. This disturbance was evidenced by the fact that enemas and cathartics were of little avail. In the few patients in this stage whom I examined there was an absence of the auscultating gurgle. At this time, before somatic paralysis had set in, there was often a history of involvement of the urinary bladder. There were relaxation and distention of this organ with overflow dribbling, indicating parasympathetic paralysis of the bladder. Since the innervation of both the intestines and the urinary bladder is sympathetic and parasympathetic, it was thought that investigations in localization might be interesting. The best way to investigate such conditions was by the use of autonomic drugs.

MATERIAL

Clearcut cases of unilateral paralysis were selected for these experiments; that is, cases in which one arm or one leg was definitely not paralyzed. Patients with slight paralysis on one side and greater paralysis on the other were not good subjects for comparative studies. Patients must be seen at the onset of the paralysis to show the difference in the reaction to drugs, since it was soon learned that sympathetic recovery as evidenced by the response to pilocarpine hydrochloride must occur very early. Nearly two hundred patients were examined, but only ninety-five were suitable for the experiments.

Many autonomic drugs, such as histamine (from 2 to 3 mg. of ergotamine), atropine, in doses of 0.02 mg., epinephrine hydrochloride, in doses of 1 mg., and ergotoxine, were administered subcutaneously, with negative results. Since it has long been known that there is a change in the vascularity of the skin over the paralyzed parts, as evidenced by coolness on palpation, experiments were made in which a physiologic solution of sodium chloride in doses of 0.1 cc. was injected intradermally over the areas of the paralyzed somatic muscles, and the absorption time was compared with that of injections made into areas of the skin over unparalyzed muscles. The results were not conclusive enough for comment.

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ADMINISTRATION OF PILOCARPINE HYDROCHLORIDE

Pilocarpine hydrochloride was then tried. When patients were admitted to the hospital, a subcutaneous injection of 0.1 grain of pilocarpine hydrochloride was administered, and notations were made on salivation, rectal tenesmus, perspiration, pilomotor reflex, condition of the pupils, vascular reactions, dermographia and subjective sensations. There was a difference in the reactions of individual patients. Escudero [1] stated that often only the parasympathetic effect of the drug was obtained with small doses. When such instances were encountered, increased doses had to be administered to produce generalized sweating. In three exceptional cases, 0.3 grains (0.01 Gm.) was given subcutaneously, 0.1 grain (0.006 Gm.) being administered at intervals of twenty minutes, and no sweating reaction occurred.

When pilocarpine hydrochloride was given to a person with somatic paralysis confined strictly to the muscles of one side, sweat appeared first in the cutaneous segmental area over the paralyzed somatic motor nerves, and the sweating persisted longer in this area than in the cutaneous areas over nonparalyzed segments.

Practically all of the patients had salivation; about 70 per cent had vesical tenesmus, and 20 per cent had rectal tenesmus. Observations on the pupils, the vascular reactions and other symptoms were of no comparative value. In these preliminary experiments, it was noted that sweating appeared first, was often greater in amount and often persisted longer on the skin over the segmental area of the paralyzed somatic nerves.

All but four of the ninety-five patients who were tested in 1929, 1930 and 1931 had definitely positive reactions to the pilocarpine hydrochloride test. (A pilocarpine hydrochloride test is considered positive when the sweating that occurs after the proper dosages have been injected starts first, is greater in amount or persists longer on the skin over the segmental areas of the paralyzed somatic nerves.)

Three of the four patients (F. G., C. R. and R. R.) who did not have positive reactions were admitted on the eighth, eighth and eleventh day of the disease, respectively, and complete recovery occurred within a few days after admission. The fourth patient (E. B.) was supposedly admitted on the fifth day of the disease, but the history was questionable. Since three of these four patients completely recovered within a few days after admission to the hospital, their normal responses on admission are not unusual.

Comment.—After the injection of pilocarpine hydrochloride, a definite difference in the sweating reaction between the unparalyzed side

1. Escudero, Pedro: Pilocarpine and Atropine Tests, Endocrinology **7**:305, 1923.

and the paralyzed side was observed in the typical selected case. When small doses of pilocarpine hydrochloride were given, an effect limited closely to the parasympathetic system was noted. The doses employed did not merely stimulate the parasympathetic system; if the dosage given did not induce generalized sweating, a dosage large enough to accomplish this purpose was employed. The usual belief is that the generalized sweating which ensues after the injection of large doses of pilocarpine hydrochloride is not due to a stimulation of the sweat glands per se and is not the result of a direct stimulation of the thoracolumbar antagonist, the parasympathetic system, but rather, that it is the result of vascular changes.

ADMINISTRATION OF PILOCARPINE HYDROCHLORIDE AND EPINEPHRINE HYDROCHLORIDE

Thus far the only demonstrable effect was an increase in sweating over the paralyzed as compared to the nonparalyzed area, but this evidence, though interesting, did not localize the disease. To connect this sweating with the sympathetic system required further experimentation.

Since the sweat glands are supplied only by the thoracolumbar outflow, and since epinephrine hydrochloride is almost a specific in stimulating this system, it was decided to try the effect of that drug after the patient has been stimulated to sweat by pilocarpine hydrochloride.

The procedure was as follows: Immediately on the patient's admission to the hospital, 0.1 grain of pilocarpine hydrochloride was injected subcutaneously. If this dose did not produce generalized sweating, the injection was repeated until there was definite generalized perspiration. The object in this set of experiments was to produce sweating, and fine differentiations as to when and where it first started were not made. Thirty minutes after the patient's admission, 0.1 mg. of epinephrine hydrochloride was injected intravenously or 1 mg. subcutaneously. The pulse rate and the blood pressure were noted after the latter injection; however these readings were of no definite value, and could be ignored. Seventy patients received injections.

Results.—A positive reaction to the pilocarpine hydrochloride test has been defined. A positive reaction to pilocarpine epinephrine hydrochloride took place when the sweating produced by the pilocarpine hydrochloride disappeared after the injection of epinephrine hydrochloride on the skin over the normal areas and persisted on the skin over the segmental areas of the paralyzed somatic nerves.

Forty (group 1) of the seventy patients tested were tested within seven days, and thirty (group 2) were tested from eight to nineteen days after the onset of symptoms.

Group 1 (Admitted Early): On admission thirty-nine of the forty patients admitted early in the course of the disease gave positive reactions to the pilocarpine hydrochloride test and also to the pilocarpine epinephrine hydrochloride test. One patient gave a positive reaction to the pilocarpine test and a negative reaction to the pilocarpine epinephrine hydrochloride test. This patient (D. H.) was admitted on the first day of the disease, and had paralysis of only the seventh nerve.

Group 2 (Admitted Late): Eleven of the thirty patients admitted late in the course of the disease gave positive reactions to the pilocarpine test and to the pilocarpine epinephrine hydrochloride test on admission. Fifteen patients had positive reactions to the pilocarpine hydrochloride test and negative reactions to the pilocarpine epinephrine hydrochloride test. Four patients had a negative reaction both to the pilocarpine hydrochloride test and to the pilocarpine epinephrine hydrochloride test.

Comment.—The sweating induced by the administration of pilocarpine hydrochloride stopped promptly after the injection of epinephrine hydrochloride over the areas not paralyzed and continued in the skin over the paralyzed side in the patients admitted to the hospital early in the disease. Nineteen of the thirty patients who were admitted late had recovered the ability to respond to thoracolumbar stimulation, irrespective of the extent of somatic paralysis, since, when an injection of epinephrine hydrochloride was given, sweating ceased over the paralyzed areas as quickly as over the areas not paralyzed.

RECOVERY IN AUTONOMIC PARALYSIS

Each patient admitted was retested twenty-one days after the onset of the disease. Pilocarpine hydrochloride was given first and epinephrine hydrochloride later, as previously described. This time, all of the patients were given injections, irrespective of the stage of paralysis present on admission.

Since in parasympathetic paralysis of the bladder recovery occurs within a few days, it was thought that in the other autonomic paralyses recovery might occur as quickly, no matter how severe the somatic involvement that still persisted. Injections of autonomic drugs should give some evidence of this recovery.

Ninety-five patients were tested. Four of them had a positive reaction both to the pilocarpine hydrochloride test and to the pilocarpine epinephrine hydrochloride test; five had a slightly positive reaction to the pilocarpine hydrochloride test but a negative reaction to the pilocarpine epinephrine hydrochloride test; eighty-six had a negative reaction both to the pilocarpine hydrochloride test and to the pilocarpine epinephrine hydrochloride test.

COMMENT

By these tests, it was seen that the faculty of sweating was recovered quickly in the majority of cases, irrespective of the extent of somatic paralysis. Patients who had massive paralysis in whom atrophy of the paralyzed muscles and typical lardaceous thickening of the skin over the paralyzed area later developed had diminution of sweating, and in two instances, two years later, an absence of sweating over the paralyzed side. The diminution of sweating in these cases, however, could be attributed to secondary conditions that arise in the skin covering parts of the body not used.

From these experiments, one can conclude that in infantile paralysis the sympathetic nervous system is involved in a segmental fashion just as soon as the somatic system.

There was no difference between the two sides as regards the sweating produced by the injection of pilocarpine hydrochloride in thirty-four normal persons. The injection of epinephrine hydrochloride in these persons caused simultaneous cessation of sweating on the sides compared.

SUMMARY

1. When patients with early infantile paralysis were given injections of pilocarpine hydrochloride in doses sufficient to produce sweating, sweating started sooner, persisted longer and was often greater in amount on the skin over the segmental areas of the paralyzed somatic nerves than it was on the skin over the normal nerves.

2. When epinephrine hydrochloride was injected into such a patient, the sweating usually persisted over the paralyzed area, whereas it stopped promptly over the side not paralyzed.

3. Within twenty-one days after the disease had started, practically all of the patients with infantile paralysis had recovered to the extent that the sweating response to pilocarpine hydrochloride was equal over the paralyzed and the nonparalyzed sides. In general, the response to injections of epinephrine hydrochloride at this time was not objectively different from that present in normal persons.

Case Reports

PREADOLESCENT ANEOPLASTIC DYSPITUITARISM OF LORAIN TYPE

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Pituitary dysfunction, usually of the hyposecretion type, occurring in children before or during adolescence, is not a rarity. The result of this hyposecretion, however, is, in the majority of cases, obesity with genital and secondary sexual retardation. I shall present a case of hyposecretion of the anterior lobe resulting in emaciation with marked genital and secondary sexual retardation. Lorain,[1] in 1871, published the first exact clinical description of this type of infantilism, but he did not associate the condition with a lesion of the pituitary gland. De Sanctis, in 1905, first associated this form of infantilism with an abnormal endocrinologic condition. In 1908, E. Levi published a case in which roentgenograms showed an enlarged and deformed sella turcica, probably due to the presence of a pituitary tumor. H. Cushing reported a case in 1912. Blair Bell, in 1919, and Parkes Weber, in 1921, also published a few cases in which the roentgenogram showed the presence of a shallow but not an enlarged sella. It is probable that in such cases the pituitary body or a portion of it is either atrophied or congenitally absent. Lorain's original definition of this condition is as follows:[1] ". . . an arrest of development which affects the mass of the individual rather than any special organ, causing delicacy and smallness of the individual and a genital dystrophy." In the more recent literature, pituitary hypofunction in children is reported as producing approximately as many cases of sexual dystrophy without as with obesity. However, if a clinician is confronted with a typical case of the Lorain type, that of the delicate, fragile child with slightly old appearing facies, symmetrically retarded in mass and with complete lack of sexual development, he admits that such a case is still unusual enough to warrant recording.

Before discussing clinically the case to be reported, it is necessary to consider the derivation and make-up of the pituitary and the associated system of ductless glands. In trying to reason out the mechan-

1. Quoted by Worster-Drought, C.; Dickson, W. E. C., and Archer, B. W. C.: Brain **50**:705, 1927.

ism of causation and the etiologic factors in this mechanism, one is impressed by the fact that the facts known about endocrinology are rather vague and conflicting as, unfortunately, it is not a field which lends itself readily to experimentation on human beings. The derivation of the hypophysis is from an evaginated portion of the ectodermal pouch of Rathke, which grows upward under the brain stem from the pharyngeal epithelium.[1] The gland lies in a recess of the sella turcica, being connected with the brain behind the optic chiasma by the infundibular stalk. The anterior lobe is from a pharyngeal evagination, while the posterior lobe is derived from the infundibular stalk. The pars media is derived from the posterior wall of Rathke's pouch; the pars tuberalis is derived from an inconspicuous prolongation of the tissue of the anterior lobe extending along the infundibulum. The anterior lobe is made up of (1) the pars anterior propria, (2) the pars intermedia and (3) the pars tuberalis. Comparatively recent studies of the histology of the anterior lobe have added a great deal to the understanding of how and why certain clinical manifestations result in one case and not in others. The anterior lobe is composed of epithelial cells arranged in acini-like structures. These cells are in two sets: (1) the chromophilic, which stain deeply, take acid dyes and have granular cytoplasm, and (2) the chromophobic cells, which remain clear and take basic dyes. It is thought that the eosinophilic cells control growth, as excessive amounts of the hormones from these cells have been found in the blood and urine of adults suffering from pituitary adenoma, resulting in overgrowth. The genital hormone is thought to be derived from the basophilic and chromophobic cells, and it is not produced until the later years of juvenility. It is established that the anterior lobe controls growth and sexual development, but it is not so clear which part of the pituitary gland regulates fat metabolism. Some authors think that this is the function of the posterior lobe, while others think that this function can be assumed by centers in the hypothalamic area (tuber cinereum) of the surrounding brain (Erdheim was the first to suggest this). Most authors agree that the posterior lobe controls urinary output and is a factor in temperature regulation, the basal metabolic rate and sugar tolerance.

P. E. Smith [2] showed by operative measures that cachexia of pituitary origin and dystrophia adiposa genitalis are dependent on totally different processes. Some explanation is necessary to show why a suprasellar cyst will produce adiposity (Fröhlich's syndrome) in one person and the Lorain type of dystrophy without obesity in another. Smith found that lesions of the hypothalamic region of rats gave rise

2. Quoted by Frankl, O. (University of Vienna): Personal communication to the author.

to a syndrome of extreme obesity and atrophy of the genital system without changes in the thyroid or suprarenal cortex. Destruction of the anterior lobe gave rise to complete inhibition of growth in young animals and cachexia in the old, and to atrophy of the genitals, thyroid, parathyroid and suprarenal cortex. It seems that Fröhlich's syndrome must be a result of hypofunction of the posterior and middle lobes as well as of hypofunction of the anterior lobe, while the Lorain type must be due to hypofunction of the anterior lobe alone; thus a cyst or defect that compresses or atrophies both lobes will result in a Fröhlich's syndrome, while a defect leading to hypofunction of the anterior lobe alone leads to a Lorain type of dystrophy, and, depending on the age when the latter lesion occurs, will result in the retardation of growth if the hypo-

Fig. 1.—Appearance of patient, showing marked retardation of sexual development. Note the delicate, frail body build.

secretion occurs before ossification of the epiphysis. If there is only slight retardation in growth, the anterior cells are partially functioning, or the lesion occurred late in the juvenile years. Retardation of sex development will be noted at adolescence if the lesion occurs before or at adolescence, for not before this time does the sex hormone appear (a preadolescent lesion might occur, destroying these acidophilic cells in the anterior lobe, and sex retardation be noticed only at adolescence). This point of view is not the universally accepted one, but it seems to me logical. The many conflicting opinions on endocrinology make it imperative that one stop somewhere and try to draw some conclusions. I should state here that in a paper reported in 1927 by Worster, Drought, W. E. Carnegie Dickson and B. W. Crowhurst Archer,[1] the following statement was made: "Present day tendency is to regard the pituitary body together with the nuclei of the hypothalamic region as a

complex neuro-glandular mechanism rather than to adhere to the view that each lobe, anterior and posterior, is an independent endocrine organ." They further state: "The presence of a lesion that must have involved the whole structure of the pituitary mechanism—nervous and glandular—almost suggests that this condition (Lorain dystrophy) is in reality an 'apituitarism' while the Froehlich's is due to a partial lesion of the pituitary mechanism—might well be called dyspituitarism or merely disordered pituitary function on the side of diminished activity."

Frankl [2] also expressed the belief that the pituitary hypofunction resulting in a Lorain type of dystrophy is probably due to apituitarism. He stated that the reason that there is no adiposity in such cases is that the entire pituitary system is destroyed, and that the thyroid and gonad are doing compensatory work.[2] The thyroid in this case is certainly not overactive; on the contrary, it is underactive.

REPORT OF A CASE

The patient was first seen on April 14, 1932, because of severe diffuse, cramping abdominal pain. It disappeared completely and permanently after the administration of an enema. At this time it was noted that the patient was extremely malnourished; he was a frail, thin child who was definitely "below par." His facies was much older than was normal for his age (17½ years). His voice was thin and of a higher pitch than was normal for his age. The genitalia were much retarded in development; they were approximately those of a boy 8 or 9 years old. There was a complete absence of pubic hair; both testicles were in the scrotum, but they were smaller than normal. The respiratory cardiac and urinary systems were normal. He was advised to come to the office for a more complete examination.

On April 27, his measurements were: span, 62¾ inches (normal, from 65.6 to 70.6); height, 63¾ inches (normal, from 63.8 to 68.2); weight, 89½ pounds (normal, from 106.8 to 135.2); upper part of body (greater trochanter to vertex), 29 inches (normal, from 31 to 34); lower part of body, 35¼ inches (normal, 35); head, 22½ inches (normal, 22.3); waist, 24 inches (normal, 28), and chest (in exhalation), 28 inches (normal, 33.3).

From these comparisons it will be seen that he was approximately 30 pounds (13.6 Kg.) underweight; that his height was normal, and that his body was symmetrical. The measurements of his waist and chest give one an idea of his extremely slim and frail make-up. The muscles of the face, shoulders and the upper part of the trunk appeared to be unusually underdeveloped, though this was partially due to an absence of fatty subcutaneous tissue. The fingers were long and tapering; there was no tremor. The skin was normal in texture. The hair was soft and silky. The blood pressure was 85 systolic and 70 diastolic, low for his age; the pulse rate, 72, slightly slowed. A Wassermann reaction of the blood was negative.

Examination of a roentgenogram of the head revealed diffuse mottling and dimpling of the bones of the skull; the sella turcica was normal in appearance though two areas of abnormal calcification were noted, one apparently in the sella and one just above it. On roentgenographic visualization, the suprasellar calcifica-

tion proved to be in the temporal bone; the small area of calcification, which seemed to be in the sella itself, was not seen. The floor of the sella was smooth; there was no erosion or decalcification of the clinoid processes. The eyegrounds and the visual fields were normal. Perimetric examination gave negative results; there was no defect in appreciation for color. The sugar tolerance test made during fasting showed 200 mg. per hundred cubic centimeters of blood; at the end of one-half hour, 350 mg. per hundred cubic centimeters; at the end of an hour, 250 mg. per hundred cubic centimeters. The curve showed approximately a normal response though the reason for the blood sugar content during fasting is not

Fig. 2.—Roentgenogram of the skull showing intrasellar shadow; the only evidence to be found, of a cyst, about the hypophysis. The exact reason for this abnormal density is not known, but a cyst does not seem likely.

known. This has not yet been repeated for check-up. No glycosuria was noted with a high blood sugar content during fasting.

The basal metabolic rate was —21.8 per cent; a blood count made on April 28 showed: 4,120,000 red cells; hemoglobin, 80 per cent; white cells, 13,050; polymorphonuclears, 59 per cent; large lymphocytes, 8 per cent; small lymphocytes, 32 per cent, and transitionals, 1 per cent. Urinalysis gave negative results. There was no diabetes insipidus; the twenty-four hour intake and output was within normal limits. Spinal tap and encephalography were not permitted by the parents. The clinical history in this case was not of much assistance. The family had noticed for several years that the boy was not developing as he should, but nothing was done about it. The family history on both sides revealed that no endocrine disorders had been present. There was no history of tuberculosis in the family. Three brothers and three sisters were of normal size and development.

COMMENT

In the beginning, the condition was thought to be one of hypopituitarism as a result of pressure on the gland from an adjacent suprasellar cyst of Rathke's pouch. However, the only evidence of this has been the suprasellar and intrasellar calcification which may be in a vessel or plexus of blood vessels. The patient had no clinical symptoms of increased intracranial pressure. No changes were found in the ocular fundi. No positive neurologic signs were noted, and no pathologic process was observed in the visual fields. The size of the sella would not indicate a congenital absence of part of the glands, as one would then expect a small shallow sella. Blair Bell, in 1919, and Parkes Weber, in 1921, published a few cases in which they indicated that this was true.[1] If this were true in the present case, one would expect, if the anterior lobe was affected at birth, a very early disturbance in growth. The boy evidently had hypofunction of the anterior pituitary lobe, as evidenced by lack of sexual development, and although he was almost of normal height for his age, the epiphyseal centers would most probably show retarded ossification. (He refused to return for further roentgen studies.)

How much the posterior and intermediate lobe was functioning is not definitely known. The function of these lobes is considered to be the partial control of fat metabolism, especially about the girdle and the lower part of the abdominal or pelvic region. They also influence the sugar tolerance and the blood pressure to some extent. The basal metabolism is also influenced by the dysfunction of these lobes, and the urinary output is greatly increased by their defective functioning. In this case, there was no obesity; the sugar tolerance was not increased; the blood pressure was slightly below normal, but in a person of the body build of the patient a blood pressure of 85 systolic and 70 diastolic is almost normal. The patient did not have diabetes insipidus, and the basal metabolism was only slightly below that of normal limits. Therefore one would say that in this case hypofunction seemed to be primarily of the anterior lobe, with probably secondary hypofunction of the associated system of ductless glands, such as the thyroid and gonads. The etiology of this dysfunction is unknown, but it does not appear to be a result of a suprasellar cyst. Neoplastic changes in or about the gland can be ruled out. In his latest article on the endocrine glands, Engelbach [3] stated that in a series of 609 cases of uniglandular pituitary disturbances, there were only 25 tumors; 97 per cent of the cases were not due to tumors. Aneoplastic causes are more frequent than tumors.

3. Engelbach, W.: Endocrine Medicine, Springfield, Ill., Charles C. Thomas, Publisher, 1932, vol. 3, p. 538.

He reported such causes as transitory functional disorders—emboli, thrombi, tuberculosis, syphilis and trauma. Sixteen of one hundred and forty patients with hypofunctions gave a distinct family history of endocrinopathy; hence heredity was an important causative factor in cases of disorders of the anterior lobe in adults. No hereditary factor could be proved in the present case.

Ehrenfest [4] said that the pituitary gland can be expected to show the effects of labor, since its venous system is so closely connected with the larger sinuses that are markedly exposed to the trauma of labor. Small hemorrhages could easily occur in the area of the anterior lobe. The later effects of such lesions are uncertain, but many interesting cases of genital hypoplasia, dwarfism and Fröhlich's disease have been cited as results of hypophyseal atrophies and necroses of unknown origin. The condition in the case reported may also have been due to such a lesion sustained at birth and only later in life causing enough glandular loss to become clinically perceptible. Treatment in this case should consist of injections of solution of pituitary. There is available a solution containing anterior lobe sex hormone extracted from the urine of pregnant women, and it should be used for furthering sexual development. Administration of a purified anterior lobe growth hormone is also indicated, but as yet it is not available for general use. These injections should be given over a period of several years to be most effective, and should be begun at once if results are to be obtained, for once the epiphyseal centers are ossified, no further growth and development of the body can be expected. Sexual development also is not easily stimulated after maturity is reached. The outlook for complete normalcy, even with treatment, is none too good.

SUMMARY

This case is presented because of its comparative rarity and because of the yet uncertain mechanism and etiology of such pituitary dysfunctions. It is to be lamented that this discussion has only added further to the indefiniteness of the subject, but from a study of this case, the pathologic process seems to be in the anterior lobe and not apituitarism as suggested by some authors.

ADDENDA

The patient received fifteen 1 cc. intramuscular injections of an anterior lobe pituitary preparation and by mouth twenty-five ¼ grain (0.016 Gm.) tablets of thyroid extract. After receiving this treatment he refused further treatment and was not seen until Jan. 4, 1934.

4. Ehrenfest, Hugo: Birth Injuries of the Child, New York, D. Appleton and Company, 1931, p. 133.

At this time it was noted that there had been a remarkable change in development. He was taller and heavier and his appearance was much more mature; his voice was deeper. On further examination the following measurements were made: weight, 113 pounds; height, 67 inches; span, 68 inches; head, 22¼ inches. The genitalia were greatly increased in size, and a profuse growth of pubic hair was present. In eighteen months, therefore, there was increase in span of 5¼ inches; increase in weight of 25 pounds (11.34 Kg.); increase in height of 3¾ inches; there was a rapid development of genitalia to normal appearance. He has received no medical attention since the first short course of medication as stated.

Fig. 3.—Appearance of the patient one and one half years after the taking of the first picture.

From the subsequent observations it would seem that this case was one of delayed adolescence and development due to primary hypofunction of the pituitary gland, anterior lobe, and to a secondary hypofunction of the thyroid gland. The cause of this hypofunction was not demonstrated, and the hypofunction falls under the classification of "functional atrophy." Apparently, the small impetus given to these glands by administration of an anterior lobe pituitary and thyroid preparation was sufficient stimulus to cause them to maintain their normal secretions. The possibility of a spontaneous increase in secretion of the anterior lobe of the pituitary gland without the aid of injections is evident, but from the course of events it seems that the injections were definitely of value.

CONGENITAL CHYLOUS ASCITES

APPARENTLY CURED BY ROUTTE'S OPERATION (VENOUS PERITONEAL ANASTOMOSIS)

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LINCOLN, NEB.

The case here reported is that of an infant who had a condition which is infrequently met with, namely, congenital chylous ascites. In the review by Wallis and Schollberg [1] of 171 reported cases of milky ascites, no congenital case is mentioned, and only 3 patients were under 1 year of age. In an analysis of 128 reported cases by Boston,[2] there was only a single case reported as congenital, and 6 patients were under 1 year of age.

After searching in available literature at considerable length, I concluded that my patient must be by far the youngest ever subjected to the procedure of venous-peritoneal anastomosis, and since the procedure brought apparent clinical cure, I deem it worthy to be reported.

No attempt will be made to review the literature on the subject of congenital chylous ascites or to discuss the etiology.

REPORT OF CASE

History.—R. T., a boy, aged 5 months, was seen by me for the first time on Feb. 19, 1932. His father, aged 31, a laborer, was living and well. His mother, aged 25, was well also, and he had a sister 6 years old, who was well. The family history was irrelevant. The complaints were: enlargement of the abdomen, vomiting, loss of weight and rupture.

The abdominal enlargement was present to a marked degree at birth. It increased progressively. Recently, apparently because of the intra-abdominal pressure, it had become impossible for the child to retain his meals. Much of the food was vomited before he had a chance to finish his meal. The parents believed he had lost weight. The scrotum was swollen. This condition also was present at birth.

The baby was born at full term on Sept. 7, 1931. His weight at birth was 9 pounds and 12 ounces (4,422.53 Gm.). The delivery was difficult. The baby's abdomen is said to have measured 19 inches (48.26 cm.) in circumference.

Because of the large abdomen and apparent large scrotal hernias, the physician in attendance is said to have stated that the infant was a monstrosity and could not live. He is said to have given it no attention after delivery. A woman, a neighbor, is said to have tied the cord.

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1. Wallis, R. L. M., and Schollberg, H. A.: Chylous and Pseudochylous Ascites, Quart. J. Med. **4**:153, 1911.

2. Boston, L. N.: Chylous Ascites with Eosinophilia, J. A. M. A. **44**:513 (Feb. 18) 1905.

The baby was breast fed. He seemed to make good progress in his physical development. He was never ill. Most of the time his bowels functioned normally, and the stools were normal. Only exceptionally had it been necessary to give him an enema. Some time during his fourth month oatmeal gruel and a cow's milk formula had been added to his diet. He nursed the breast irregularly and frequently, especially during the night.

Fig. 1.—Congenital chylous ascites, as first seen in the patient at the age of 5 months.

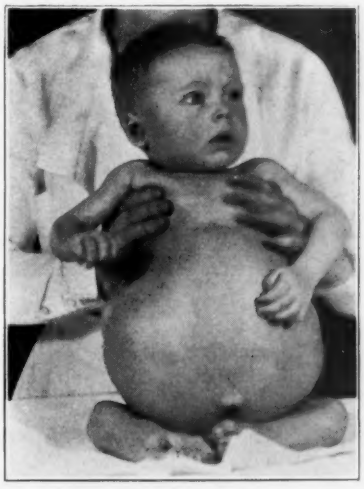

Fig. 2.—Same as figure 1.

Examination.—The baby presented a sorry picture (figs. 1 and 2). He had the largest abdomen I have ever seen in an infant of his age. He made one think of a toy rubber balloon to which are attached a paper head and dangling paper arms and legs. The scrotum bulged irregularly and was so distended that the penis was buried by it. It contained fluid which was easily forced into the abdominal cavity. The abdominal walls were tense; the cavity was filled with fluid. The enlargement was symmetrical. The intra-abdominal pressure had forced the diaphragm upward, displacing the lungs and heart, and spreading the lower ribs. Excepting the abnormalities described, and the fact that the child was quite pale, he seemed to be normal. He was bright and as active as he could possibly be.

He measured 25½ inches (64.7 cm.) in length, weighed 20 pounds and 1 ounce (9,100 Gm.). (Much of the weight must have been due to the intra-abdominal fluid.) The circumference of the head was 17 inches (42.55 cm.); the chest measured 16¼ inches (41.3 cm.) and the abdomen, 24¼ inches (61.6 cm.).

Examination of the blood showed: hemoglobin, 58 per cent; red cells, 4,090,000; white cells, 7,200; polymorphonuclears, 58 per cent; small lymphocytes, 30 per cent, and large lymphocytes, 12 per cent.

A roentgen study of the abdomen after an opaque meal showed no abnormality in the passage of the meal through the gastro-intestinal tract.

Because of the vomiting and loss of weight, the parents were persuaded to hospitalize the infant and to permit exploratory opening of the abdomen.

Operation and Course.—On February 22, he was admitted to the Lincoln General Hospital, and Dr. H. H. Everett opened the abdominal cavity and drained what was estimated to be about a gallon of milky fluid, which was free in the cavity. Because of the age of the patient, it was thought unwise to attempt to determine the source of the fluid. The surgeon's notes showed that the peritoneum was dull and appeared to be inflamed. The liver appeared small and nodular.

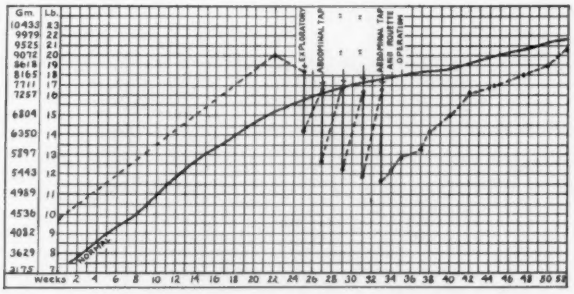

Fig. 3.—Weight chart showing the effect of abdominal drainage by trochar and the result of the Routte operation.

Seven days following drainage by abdominal incision the infant was discharged from the hospital in good condition.

From that time on for a period of about two months, he was brought to the office every two weeks, and the reaccumulated fluid was removed from the abdomen through a trochar. The accompanying weight chart (fig. 3) shows what occurred, and the amount of fluid that was removed at each tapping. It will be noted that on each succeeding occasion he weighed less after tapping than he had weighed after the previous tapping. It was apparent that the patient was losing ground.

A search in the literature on this subject led to Sajou's "Analytic Cyclopedia of Practical Medicine" [3] and to a case report by Morse.[4] Both of these references contained descriptions of Routte's operation.

On May 4, this procedure was instituted by Dr. H. H. Everett, assisted by Dr. Roy H. Whitham. Following is the surgeons' description of the operation:

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3. Gordon, W. S., in Sajous: Annual and Analytical Cyclopaedia of Practical Medicine, ed. 9, Philadelphia, F. A. Davis Co., 1920, vol. 2, p. 198.

4. Morse, G. W.: A Case of Chylous Ascites: Venous Peritoneal Anastomosis; Recovery, Boston M. & S. J. **166**:294, 1912.

"A vertical incision was made along the anteromedial aspect of the left thigh extending upward to a point about 1 inch below the inguinal ligament. The great saphenous vein was identified and isolated from the saphenous opening downward for a distance of about 3 inches. Its tributaries were ligated and divided close to the vein. The distal end was ligated and divided proximal to the ligature. A

Fig. 4.—The patient at the age of 14 months. The arrows point to the operative scars.

Fig. 5.—Same as figure 4.

small low left rectus incision was made into the peritoneal cavity. With blunt forceps, a subcutaneous tunnel was made from the lower end of this incision to the upper end of the first incision and the cut end of the vein grasped and drawn up into the abdominal incision. The end of the vein was split, drawn through a small opening in the peritoneum medial to the incision, and the two arms of the

split vein fixed to the parietal peritoneum on either side of the opening with fine catgut. The incisions were both closed in the usual manner with catgut."

Recovery was rapid and uneventful, and since the time of the operation there has been no reaccumulation of fluid in the abdominal cavity.

The weight chart shows that on September 7, at the age of 1 year, the infant had attained the average weight. Figures 4 and 5 show that his development has been normal and that there is at present no enlargement of the abdomen. Apparently the scrotal hernias have closed. The baby has six teeth and tries to walk unsupported.

CONCLUSIONS

A case of congenital chylous ascites is reported in which repeated trochar tappings of the abdominal cavity resulted in a gradual downward course of the weight curve and of the patient's general condition. Venous peritoneal anastomosis resulted in apparent cure of the condition.

REMISSION IN TUBERCULOUS MENINGITIS

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MILWAUKEE

Report of recovery from tuberculous meningitis is no longer met with the skepticism of only a few years ago; while the fact that patients sometimes recover is recognized, such recovery is extremely rare. Indeed, it is so rare in this disease that the question immediately arises, "Was the diagnosis correct"?

There are many cases in the literature on tuberculous meningitis in which recovery is reported. In 1909 Martin [1] collected 20 cases; in 1913 Pitfield [2] increased the number to 29; Cramer and Bichel [3] collected 250 cases, but considered only 46 as authentic; in 1931, Kramer and Stein,[4] in a review of the literature to date, selected 73 cases which they considered to be authentic. The tubercle bacillus was present in 47 of the 73 cases; it was not found in 16, and it was not mentioned in 10. Inoculation into guinea-pigs gave positive results in 30 cases, negative results in 4, and was not mentioned in 39. In 15 cases in which tubercle bacilli could not be demonstrated in the spinal fluid, the diagnosis was established by positive results of inoculation into guinea-pigs. In 10 instances tubercle bacilli were present in the spinal fluid, and inoculations into guinea-pigs gave positive results.

REPORT OF A CASE

A girl, aged 6 years, entered the hospital on May 18, 1931, with the complaints of headache, vomiting, fever and delirium. She had complained of headache five days before entrance; vomiting took place on that day. The symptoms continued, being followed shortly by almost continuous convulsions. The child was unconscious when first examined. At that time there was no rigidity of the neck. The knee jerks were hyperactive and equal. A Babinski sign was present bilaterally. Gordon and Oppenheim signs were absent. There was no ankle clonus. The abdominal reflexes were sluggish. The pupils were dilated and reacted very slowly to light. There were no ophthalmoscopic changes. Rigidity of the neck developed after a few days. Observations on the spinal fluid were as follows:

From the Department of Pediatrics, Marquette University, and the Milwaukee Children's Hospital.

1. Martin, Alfred E.: The Occurrence of Remissions and Recovery in Tuberculous Meningitis, Brain **32**:209, 1909.

2. Pitfield, R. I.: Recovery from Tuberculous Meningitis, with Report of Cases, Am. J. M. Sc. **146**:37, 1913.

3. Cramer, A., and Bichel, G.: La méningite tuberculeuse, est-elle curable? Ann. de méd. **12**:226, 1922.

4. Kramer, D. W., and Stein, B. B.: Tuberculous Meningitis with Syphilitic Meningitis Terminating in Recovery, Arch. Int. Med. **48**:576 (Oct.) 1931.

May 18: The spinal fluid was under increased pressure and clear; it contained 90 cells; the globulin reaction was 2 plus.

In the Levinson test, 1 cc. of spinal fluid and 1 cc. of a 2 per cent solution of mercuric chloride gave a precipitation of 3 plus; 1 cc. of spinal fluid and a 6 per cent solution of sulphosalicylic acid gave a precipitation of 1 plus.

The Wassermann and Kahn tests were negative.

May 20: The spinal fluid cell count was 237, with 95 per cent lymphocytes. The sugar was 73 mg. The Levinson test was positive for tuberculous meningitis.

May 24: The spinal fluid was under increased pressure and contained 102 cells, mostly lymphocytes; a pellicle formed but no tubercle bacilli were found.

May 27: An intraperitoneal inoculation was made into a guinea-pig.

May 29: The spinal fluid contained 94 cells, with 85 per cent lymphocytes. A pellicle formed, and acid-fast bacilli were found.

June 6: The spinal fluid contained 33 cells. The Levinson test was negative. The sugar was 60 mg. There was no pellicle.

June 18: The spinal fluid contained 11 cells; the globulin reaction was negative. The Levinson test was negative. There was no pellicle.

July 8: Autopsy was performed on the guinea-pig; sections of the spleen were positive for tuberculosis. The liver was normal.

July 10: The spinal fluid contained 15 cells; the globulin reaction was negative. The Levinson test was negative. There was no pellicle.

Clinically, there was improvement in the child's condition after about two weeks. This improvement kept pace with the clearing of the spinal fluid. After two months the patient was still unable to talk, but she understood what was said to her. There was no apparent ocular palsy or paralysis of the face or the tongue. There was gross ataxia of the upper and lower extremities, with mildly paralytic phenomena on the left. The tendon reflexes were hyperactive.

During the past two and one-half years the patient had shown slow but steady improvement. She was able to talk and she understood what was said to her. Her gait was slightly spastic. The knee jerks and ankle reflexes were equal and hyperactive. Babinski, Shattuck, Gordon and Oppenheim signs were not present. There was a gross intention tremor in the finger-to-nose test, with some apparent ataxia. Internal strabismus of the left eye remained, but there was no limit to the range of ocular movements. Both pupils reacted to light and in accommodation. The eyegrounds were normal. There was no paralysis of the tongue or the face. The residual finding was the spasticity of the arms and legs. This seemed to be equal on the two sides.

COMMENT

This case appears to be one of acute but not widespread meningitis following the rupture of a tuberculoma. The acute attack subsided, but possibly the tuberculoma persists, resulting in the symptoms that are still present.

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CONGENITAL RECTOVESICAL ANASTOMOSIS

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AND
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The case of congenital rectovesical anastomosis reported here is one of unusual rarity. In books on anatomy, pathology and embryology one finds reference to the condition of imperforate anus as a relatively frequent congenital anomaly. Congenital absence of the anus with associated patent connection between the intestinal and urinary systems is a condition referred to but rarely in the literature and makes this case worthy of consideration.

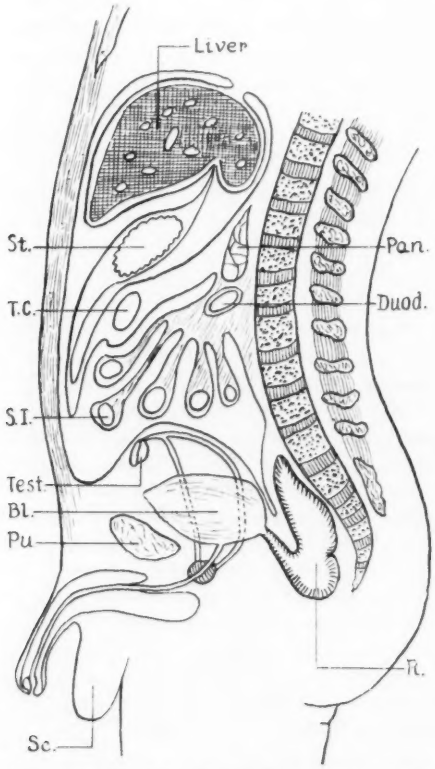
REPORT OF CASE

History.—F. P., a white boy, aged 2 days, was admitted to the surgical service of the Holy Name Hospital, Teaneck, N. J., on July 15, 1932. There was a history of his having passed fecal material by way of the urethra since birth, forty-eight hours previous to admission. Delivery had been normal in every respect. On examination it was found that there was a congenital imperforate anus. There was marked abdominal distention, and the baby was in poor condition. The temperature on admission was 100.8 F., the pulse rate 174 and the respiratory rate 104. The patient was immediately prepared, and through a small perineal incision, an attempt was made to locate the rectum, the creation of an artificial anus being desired. The rectum could not be found, and a diagnosis of congenital absence of the anus with possible congenital absence of the rectum was made. A lower left rectus incision was then made, and a colostomy performed on the descending portion of the colon. Owing to the patient's condition and age it was thought inadvisable to do any extensive exploration at this time. He reacted well to the operation and was given dextrose by hypodermoclysis at stated intervals during the stormy postoperative course of fifteen days. He died on the fifteenth day, and a limited autopsy was permitted.

Autopsy.—This was limited to the abdomen and to those structures readily accessible through the small colostomy incision. The stomach, spleen, kidneys, liver, mesentery and peritoneum were grossly normal. There was nothing grossly abnormal about the small intestine. There was an unusually long appendix, closely bound to the cecum retrocecally. Bilateral cryptorchidism was evident, the testicles being contained in the abdomen and covered by the peritoneum just above the superior tip of the bladder on the anterior abdominal wall. The large intestine was normal throughout its length to the sigmoid flexure, with the exception of that region in the midportion of the descending colon where the colostomy had been effected. At this point the sutures were found to be intact and the tissues well approximated. There was no evidence of infection here or elsewhere. At the sigmoid flexure the colon became slightly constricted, and continued into the rectum with a gradual decrease in the size and diameter of the lumen. At the most distal point of the rectum the constriction was marked. The rectum followed a normal course to about midway in the pelvis, where it flexed anteriorly on itself

and entered the bladder in its posterior aspect, immediately posterior to the urethral orifice. The bladder was normal throughout, with the exception of an orifice in the midportion of the trigon through which a probe could be passed into the rectum. The relationships of the trigon, ureteral orifices and prostate were normal. The bladder, testicles and rectum were removed for microscopic study.

Microscopic Examination: The sections made from the removed tissues showed nothing of significance from a pathologic or embryologic standpoint. The bladder was lined with normal columnar epithelium of a transitional type and showed no



Midsagittal section as visualized by the authors: St., stomach; Pan., pancreas; Duod., duodenum; T. C., transverse colon; S. I., small intestine; Test., testicles; Bl., bladder; Pu., pubis; R., rectum; Sc., scrotum.

evidence of overdistention or overcontraction. This type of epithelium continued for the usual distance into the urethra, as far as the membranous portion, where it underwent normal transition into stratified epithelium. There were no circular fibers of muscle about the rectovesical orifice that would suggest a sphincter or pseudosphincter. On the bladder side of the rectovesical orifice no change was noted in the character of the epithelium, the same being true of the rectal side. The epithelium of the rectum was essentially normal, columnar epithelium being present. The prostatic tissue was normal in every respect. To sum up the microscopic studies, all the structures examined were essentially normal histologically, there being no apparent change as a result of the abnormality.

COMMENT

According to Arey,[1] the cloacal membrane is intact in embryos of 1.4 mm. (from 3 to 4 weeks). The saddle-like partition between the allantois and the intestine grows caudally, and divides the cloaca into the rectum and the primitive urogenital sinus. The urogenital sinus later gives rise to the bladder itself. This process of division is complete in embryos of from 11 to 15 mm. (6 to 7 weeks). The partition becomes fused with the cloacal membrane and divides it into the anal membrane and the urogenital membrane, the intermediate tissue forming the perineum. When the anal membrane ruptures, at about the ninth week of fetal life, the anus is formed. Failure of this membrane to rupture accounts for the well known imperforate anus. In the case reported here the membrane itself was congenitally absent; hence the anus was congenitally absent. Accordingly, in our opinion, there must have been a developmental retardation, cause unknown, previous to or about the seventh week of fetal life. This retardation was apparently confined to the growth of that partition which functions to divide the cloaca into the rectum and the urogenital sinus, or bladder-to-be. The process of division was apparently normal up to a point between the sixth and seventh week because the bladder and rectum had developed to a point in keeping with that period. However, at that time developmental inhibition took place, leaving the rectum and developing bladder with a patent connection or anastomosis between them. Subsequent to this arrestment normal embryologic development apparently progressed, as is shown by the normal histologic appearance. The anastomosis, however, was permanent. The cloacal membrane obviously was never divided, owing to the inhibition in the growth of the dividing partition, fusion between the two then being impossible. Hence the anal membrane was never formed, and congenital absence of the anus resulted.

1. Arey, L. B.: Developmental Anatomy, Philadelphia, W. B. Saunders Company, 1924.

Progress in Pediatrics

ACUTE ENTERITIS IN INFANTS AND IN YOUNG CHILDREN

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CINCINNATI

II. CLINICAL STUDIES ON FORTY-SIX PATIENTS WITH ACUTE ENTERITIS; NECROPSY STUDIES

CLINICAL STUDIES

The many studies of the bacteriology of acute enteritis in infants and children have failed to agree on any single microbic etiologic factor. The majority, however, have incriminated various members of the B. dysenteriae group, mainly on the basis of their presence in the stools of such patients. This in itself is not a sufficient criterion for such a deduction. In common with others, we have isolated organisms of the dysenteriae group from the stools of normal infants and young children or of subjects with conditions other than enteritis.

The present report details clinical and certain bacteriologic data on a series of forty-six patients with acute enteritis who were studied during the fall of 1931. There was no selection of cases. Cultures were made as soon as possible after admission and in some instances at necropsy. Reference should be made to the first part of this article and to those parts that follow in this issue.

Clinical Description of Patients.—In table 7 is given a summary of such factors as age, infection of the upper respiratory tract and mortality. The patients were acutely ill. In the majority enteritis had developed two or three days after the beginning of an acute infection of the upper respiratory tract. The onset was sudden, with a temperature of from 103 to 105 F., vomiting, prostration, frequent stools and rapid dehydration. The stools were watery and green; most of them contained mucus; some contained blood and some, a variable amount of pus. The number of stools varied considerably. Some patients had from five to seven during the twenty-four hours, while others had from eighteen to

twenty-two. Dehydration was a striking feature in about 60 per cent of the patients and was most marked in those who had the largest number of stools, although it was present in some who had fewer stools but who, in addition, vomited. Early in the attack many of these patients had the clinical picture of an overwhelming toxemia accompanied by pronounced prostration. These comprised twenty-nine of the forty-six patients, or 63 per cent. All of the fatal cases were in this group.

Factors Predisposing to Acute Enteritis.—The important associated predisposing factors were age and a preceding and accompanying infection of the upper respiratory tract.

TABLE 7.—*Streptococcus Micro-Apoikia Enteritidis in Forty-Six Patients with Acute Enteritis, Together with Age, Incidence of Infection of the Upper Respiratory Tract and Mortality*

	Total Cases			Fatal Cases			Streptococci Present		
Age	Number	Associated U. R. I.*	Complication of U. R. I*	Number	Associated U. R. I.*	Complication of U. R. I.*	At Necropsy	In Stool	In Patients
0 to 1 mo.	1	1	0	0	0	0	0	0	0
1 to 3 mos.	7	6	1	5	4	3	2	5	6
4 to 6 mos.	9	8	2	3	3	2	1	5	6
7 to 9 mos.	8	7	3	3	3	3	1	5	6
10 to 12 mos.	6	3	2	2	0	0	0	1	1
13 to 18 mos.	1	1	0	0	0	0	0	0	0
19 to 24 mos.	4	3	0	1	0	0	0	2	2
25 to 30 mos.	2	1	0	1	0	0	0	1	1
3 to 4 yrs.	2	2	0	0	0	0	0	2	2
4 to 5 yrs.	2	1	0	1	0	0	1	3	2
11½ yrs.	1	1	0	0	0	0	0	1	1
?	3	?	0	0	0	0	0	3	3
Total.....	46	34	8	16	10	8	5	28	30

* Infection of the upper respiratory tract.

Age exercised a decided influence on the incidence of the condition. Table 7 shows that thirty-one of the forty-six patients (67 per cent) were under 1 year of age, and thirty-six (78 per cent) were under 2 years of age. This incidence of age may be compared with that of a group in an associated hospital in which of a total of one hundred and thirty-six patients with a similar type of intestinal infection admitted during the same period as that covered by this study 61 per cent were in the first year of life and 82 per cent were under 2 years of age. Age had an important bearing on mortality. Sixteen of the forty-six patients died, a mortality rate of 35 per cent. There were thirteen deaths under 1 year of age, a mortality rate of 47 per cent. Of the similar group of one hundred and thirty-six patients, thirty-seven died, a mortality rate of 27 per cent; thirty-two deaths occurred among patients under 1 year

of age, a mortality rate of 39 per cent, and twenty-seven deaths among children under 6 months of age, a mortality rate of 45 per cent.

Acute infections of the upper respiratory tract were present in thirty-four of the forty-six patients (74 per cent) just preceding, or at the time of, the onset of the acute enteritis (table 7). In eight of these thirty-four patients such complications as otitis media developed either about the time of onset of the enteritis or subsequently. It is noteworthy that all these eight patients died. Furthermore, of the thirty-four who had acute infections of the upper respiratory tract, ten died; i. e., 62.5 per cent of the total deaths occurred in this group. The intestinal tracts of twenty-two of these thirty-four patients (65 per cent) contained the streptococcus which has been described in the first part of this article (Streptococcus micro-apoikia [small-colony] enteritidis).[4a] The high incidence of infections of the upper respiratory tract in these patients, together with the accompanying bacteriologic data, suggests that the acute enteritis may well be a complication of the acute infection of the upper respiratory tract. Brown, Tisdall, Wishart, Drake and Johnston [5] studied the relation between mastoiditis and acute intestinal intoxication and concluded that "the etiologic factor in acute intestinal intoxication is not an upper respiratory infection." Rosenow [6] concluded from his studies on the etiology of gastro-intestinal influenza that his "experiments suggest there is a true gastro-intestinal type of influenza and that green-producing streptococci similar to those isolated from the respiratory type of the disease but which tend to localize in the gastro-intestinal tract, are the chief cause."

Since 1929, when we [7] reported that green-producing streptococci were frequently found in pure culture in the throats of patients in whom the initial symptoms of an influenza-like infection which at that time was spreading as an epidemic over the country developed, we have made similar observations on several outbreaks of acute infections of the upper respiratory tract. In infants and young children whose original infection of the upper respiratory tract was followed by complications such as otitis media, mastoiditis, meningitis and empyema we have isolated from these locations streptococci similar to those originally isolated from the patients' throats.

4a. The term Streptococcus micro-apoikia (small colony) is used for that group of streptococci usually called "green-producing" because the occurrence of the green area about the initial colonies is not as constant a characteristic as is the minuteness of the colonies. Enteriditis is used to designate the particular subgroup responsible for enteritis.

5. Brown, A.; Tisdall, Frederick F.; Wishart, D. E. S.; Drake, T. G. H., and Johnston, M. M.: South. M. J. **23**:107 (Feb.) 1930.

6. Rosenow, E. C.: J. Infect. Dis. **26**:557, 1920.

7. Cooper, Merlin L.: J. Med. **10**:175, 1929.

In part III [7a] of this article we report the finding of similar streptococci in the involved intestinal tracts of four of five children with acute enteritis studied at necropsy; the same type of organism was present in the blood of the fifth and in the stools of 65 per cent of a group of forty-six children with acute enteritis. In part IV [7b] it is shown that when injected into monkeys and rabbits such streptococci produced marked gross and microscopic lesions in the intestinal tracts.

The association of a preceding infection of the upper respiratory tract and of this type of streptococcus with acute enteritis in children may be illustrated by the following report of a case.

M. H. G., 2½ years of age, became acutely ill with abdominal pains, vomiting, diarrhea and a temperature of from 105 to 106 F. The stools were watery, green and frequent, and contained some mucus. The child had had an infection of the upper respiratory tract for the preceding three days. The surface of the pharyngeal wall and tonsillar fossae was gray and glassy and edematous. It was but slightly injected. Cultures from the throat contained a predominance of Streptococcus micro-apoikia. Culture of the vomitus also contained many of these streptococci. A culture of the stool was negative for this micro-organism and for B. dysenteriae. The patient died about thirty-six hours after entering the hospital, her temperature having remained 106 F. for seven hours before death. Material obtained for cultures during necropsy showed the presence in large numbers and in pure culture of Streptococcus micro-apoikia in the mesenteric lymph nodes. The organism was present also in the small intestine and in the liver in association with Bacillus coli. None of these streptococci were found in cultures from the large intestine. Studies of postmortem material from subsequent patients have confirmed the relative absence of these streptococci from the large intestine, and this probably explains the difficulty in isolating such micro-organisms from the stools collected before death. One month prior to the death of this patient her younger sister, aged 1½ years, died. She also had had an infection of the upper respiratory tract for three days before the sudden onset of an acute enteritis which lasted for forty-eight hours, or until her death. The clinical course had been exactly the same in both children. The history showed that "some member of the family had a cold all the time." Both of the children who died had had an infection of the upper respiratory tract just preceding the onset of the acute enteritis. In both marked symptoms of toxemia and prostration developed. Both children had a temperature of from 106 to 107 F. for several hours before death.

A large number of similar cases have strengthened our impression that there may be a significant relation between infections of the upper respiratory tract and acute enteritis.

In table 7 is shown the relationship between infections of the upper respiratory tract and mortality in a carefully studied group of forty-six children. Thirty-four, or 74 per cent, had obvious infections of the upper respiratory tract, while eight, or 17 per cent, had complications of the infection of the upper respiratory tract such as otitis media or

7a. This issue, page 606.

7b. This issue, page 613.

mastoiditis. It is also seen in this table that sixteen, or 35 per cent of these children died, that ten, or 63 per cent of those who died had obvious infections of the upper respiratory tract, and that 50 per cent of the fatal cases showed complications such as otitis media or mastoiditis.

A similar analysis of another group of one hundred and thirty-seven patients with acute enteritis in an allied institution shows that 72 per cent had obvious signs of an infection of the upper respiratory tract at the onset of the enteritis and that 30 per cent had otitis media. Twenty-seven per cent of this group died, and of these, 62 per cent had an infection of the upper respiratory tract, while 46 per cent had otitis media as a complication.

In each of these two groups the apparent incidence of infection of the upper respiratory tract is less in the group with fatal termination than in the group as a whole. This may be because certain patients with fatal cases were admitted to the hospital shortly before death, a number of days after the onset of the enteritis, and at a time when the symptoms of the infection of the upper respiratory tract had subsided.

Cultural and morphologic methods have not enabled us to differentiate Streptococcus micro-apoikia isolated from the throats, ears, mastoids and empyema fluids of patients without enteritis from similar streptococci isolated from the throats and stools of patients with acute enteritis. We have found that intravenous injection into rabbits does identify the streptococci which are capable of producing the typical lesions in the intestinal tracts of these animals. It was impossible to utilize this method as a routine during the course of the studies here reported because we were concentrating our efforts on a careful study of the stools and contents of intestinal tracts obtained at necropsy. Certain data were accumulated, however, which suggested that Streptococcus micro-apoikia isolated from the throats of patients with and without enteritis and from a complication of the infection of the upper respiratory tract such as mastoiditis may, when injected into rabbits, be able to produce in the intestinal tracts typical lesions, similar to those produced by streptococci isolated from the intestinal tracts of patients with acute enteritis.

The following experiment is an example of the production of the typical pathologic lesions in the intestinal tracts of rabbits by the injection of streptococci isolated in large numbers from the throat of a patient.

J. K., aged 22 months, was admitted to the hospital the day following the onset of an acute infection of the upper respiratory tract and in the early stages of acute enteritis. A culture from the throat obtained on the third day after the onset of the acute enteritis showed that 50 per cent of the micro-organisms were streptococci morphologically and culturally the same as the Streptococcus micro-

apoikia isolated from stools of patients with acute enteritis. Seven cubic centimeters of a young broth culture of this streptococcus was injected intravenously into rabbit 311. During the following five days the white cell count remained unchanged and the animal lost 300 Gm. in weight. On the fifth day a diarrhea developed and the animal died. Its intestinal tract did not show any gross pathologic changes, but the streptococcus recovered from the first portion of the small intestine in pure culture was in turn injected into rabbit 334. The white cell count of this rabbit increased 3,000; it became very ill; its temperature increased from 102.6 to 106.8 F., and it died on the second day. Necropsy showed that the small intestine was deeply injected throughout its length; the contents were thick, yellow, purulent and contained many streptococci. The streptococci were isolated from the small intestine, but cultures of the blood and spleen gave negative results. The glands in the wall of the involved small intestine appeared

TABLE 8.—*Low White Cell Counts in Cases of Acute Enteritis with Associated Infections of the Upper Respiratory Tract*

Patient	Age	Type of Symptoms	White Cell Count	Normal Average* White Cell Count	Results
Infant R.	10 days	Severely ill, dehydrated, toxic	7,900	12,000 to 14,000	Died
A. L.	2 mos.	Mild	4,000	12,000 to 13,000	Recovered
T. B.	5 mos.	Mild	6,000	12,000	Recovered
S. J.	9 mos.	Severely ill, toxic	7,400	12,000	Recovered
J. H.	11 mos.	Severely ill, toxic, dehydrated	8,500	12,000	Recovered
R. G.	1 yr.	Severely ill, toxic, dehydrated	3,500	12,000	Died
B. T.	2 yrs.	Mild	5,600	12,000	Recovered
D. R.	2 yrs.	Mild	6,000	12,000	Recovered
A. B.	3 yrs.	Severely ill	5,500	11,000	Recovered
A. R.	3 yrs.	Mild	6,200	11,000	Recovered
C. T.	3 yrs.	Mild	4,700	11,000	Recovered
H. W.	4 yrs.	Severely ill, toxic	4,200	11,000	Recovered

* According to Griffith and Mitchell.

deeply injected, purple and enlarged. Rabbit 336 was then given an intravenous injection of 4 cc. of the culture from the small intestine of rabbit 334. Its white cell count dropped from 16,000 on the day of injection to 3,200 on the second day after the injection, and the animal died on that day. It had lost 200 Gm. in weight. Its temperature rose from 103 F. before the injection to 106.4 F. four hours after the injection and to 107 F. the following day. On the second day it fell to 104 F. before death. The first portion of the small intestine presented the typical picture of the gross pathologic changes described in detail in part IV of this series. The streptococci were recovered from the small intestine and spleen but not from the blood.

Another experiment illustrates the possibility that the throat of a child with an acute infection of the upper respiratory tract but without enteritis may harbor Streptococcus micro-apoikia which, when injected into rabbits, can produce lesions in the intestinal tract similar

to those produced by the Streptococcus micro-apoikia enteritidis isolated from the intestinal tracts of children with acute enteritis.

J. C., aged 4 years, had had an acute uncomplicated infection of the upper respiratory tract for two days. About 75 per cent of the bacteria in the throat culture were Streptococcus micro-apoikia. Rabbit 602 was given an intravenous injection of 4 cc. of the original brain broth culture of this streptococcus. Its temperature rose to 106 F. within four hours and fluctuated between 106 and 103 F. until death on the fifteenth day. The rabbit lost 300 Gm. in weight, and a diarrhea developed a short time before death. Necropsy showed the typical gross pathologic lesions in the first portion of the jejunum described in part IV.

In another patient, M. M., acute mastoiditis developed following an acute infection of the upper respiratory tract. Cultures of the pus from the mastoid cells contained only Streptococcus micro-apoikia. Two mice died following injection of these streptococci. Peritoneal washings from each mouse injected intravenously killed two rabbits. Typical pathologic lesions were found in the small intestines and mesenteric lymph nodes of both rabbits, and the same streptococci were recovered from such lesions.

In table 8 are listed the age and white cell counts of a group of patients with acute enteritis, the normal average counts being given for comparison. It is seen that all of these children had low counts, in some instances only from 35 to 50 per cent of the normal average. A low white cell count, in our experience, is the usual accompaniment of any acute infection of the upper respiratory tract in which the streptococcus we are describing (Streptococcus micro-apoikia) or similar streptococci are found in large numbers and in which other pyogenic microorganisms have not instituted a complication. This is true also of cases of acute enteritis following acute infections of the upper respiratory tract in which this streptococcus predominates. All of the twelve patients listed in table 8 had had an acute infection of the upper respiratory tract preceding the onset of the enteritis. The stools of eight of these twelve patients contained Streptococcus micro-apoikia enteritidis. Fifteen other patients who had such complications as otitis media, bronchitis or cervical adenitis had high leukocyte counts. The stools of nine of the patients in this group contained Streptococcus micro-apoikia enteritidis. Still another group of six patients with enteritis and otitis media as the only complication had either normal or low leukocyte counts. The stools of four patients in this group contained Streptococcus micro-apoikia enteritidis. When cultures were taken from the complicating otitis or mastoiditis of any of the patients who had leukopenia it was invariably found that Streptococcus micro-apoikia was present in pure culture.

SUMMARY OF CLINICAL STUDIES

Age had an important influence on the incidence and mortality of the forty-six patients with acute enteritis described in this report. Sixty-

seven per cent of them were under 1 year of age, and 78 per cent were under 2 years. The total mortality was 35 per cent, but the mortality in patients under 1 year of age was 50 per cent.

High fever, vomiting, toxemia, prostration, frequent stools and dehydration were the outstanding features of this infection.

Acute infection of the upper respiratory tract was an important etiologic factor. Seventy-two per cent of the patients had such infections just preceding, or at the time of, the onset of their enteritis. In 63 per cent of the fatal cases an infection of the upper respiratory tract was present. The intestinal tracts of 67 per cent of these patients who had infection of the upper respiratory tract harbored Streptococcus micro-apoikia. This association is further detailed in part I,[7c] and will be elaborated in subsequent reports.

Certain studies detailed in this article show that pathologic lesions, the same as those produced in the small intestines of rabbits and monkeys following the injection of Streptococcus micro-apoikia enteritidis isolated from the intestinal tracts of patients with acute enteritis, have been produced in the small intestines of rabbits by injection of Streptococcus micro-apoikia isolated from the pharynx of a patient with an acute infection of the upper respiratory tract and an acute enteritis, from the pharynx of a patient with an acute infection of the upper respiratory tract but no enteritis, and from a patient with an acute mastoiditis complicating an acute infection of the upper respiratory tract.

The leukocyte counts were either normal or below the normal average in the patients infected only with Streptococcus micro-apoikia. High leukocyte counts were indicative of a complication, due to some micro-organism other than Streptococcus micro-apoikia.

NECROPSY STUDIES

Five of the children mentioned in the preceding section were studied at necropsy. All showed gross and microscopic pathologic changes in the gastro-enteric tract. Cultures of intestinal contents at various levels of the intestinal tract were made in the usual manner to avoid contamination; i. e., a sterile cotton swab was inserted through an incision in the intestinal wall made with sterile scissors in an area sterilized by application of a hot spatula. Postmortem cultures were made immediately after obtaining the material. This material was cultured and studied in the way described for cultures of stools (part I).

Streptococci (Streptococcus micro-apoikia) were isolated from the contents of the involved intestine in four of these five patients and

7c. Cooper, Merlin L.; Keller, Helen M., and Johnson, Barbara: Acute Enteritis in Infants and in Young Children: I. Bacteriologic Studies, Am. J. Dis. Child. **47**:388 (Feb.) 1934.

from the blood stream in the fifth. Four of these five cultures of streptococci were used for injection into animals, and all four cultures produced the characteristic pathologic changes in the animals' intestinal tract and were subsequently recovered from the animals.

The pathologic changes observed in the following patient are characteristic of those seen in all five patients, and they are, therefore, presented somewhat in detail.

J. H., aged 19 months, became suddenly ill on Sept. 12, 1931, with vomiting, frequent stools and fever. He entered the hospital on Sept. 16, 1931, and died on Sept. 19, 1931. He was severely toxic and dehydrated; his white cell count was 9,000, and there were no complications. The clinical diagnosis was acute enterocolitis. The anatomic diagnosis was: severe acute enterocolitis with acute mesenteric lymphadenitis; marked fatty infiltration of the liver; toxic changes in all the viscera; cerebral edema, and slight pulmonary congestion. The microscopic diagnosis was: acute ileocolitis with marked mucosal congestion and lymphoid hyperplasia; acute mesenteric lymphadenitis; marked fatty infiltration of the liver; toxic hepatosis, myocardosis and nephrosis; toxic splenitis with reticulo-endothelial hyperplasia in the centers of the splenic follicles, and cerebral congestion and edema. A more minute description of the microscopic findings in the small intestine is as follows: moderate submucosal and mucosal congestion; lymphoid tissue in the submucosa very prominent with some reticulo-endothelial hyperplasia in the center of the lymphoid nodules; edema of the wall of the intestine; marked infiltration of lymphocytes, monocytes and polymorphonuclear leukocytes, with the lymphocytes predominating in the mucosa—the same type of cells being present, but to a lesser degree, in the submucosa, where they were found at times grouped collar-like about the blood vessels. In the colon there was marked mucosal and submucosal congestion, and the peritoneal vessels were all greatly distended and filled with blood. The description for the small intestine holds good for the large except that there was an increased number of polymorphonuclear leukocytes, although lymphocytes still predominated.

Comparison of the Pathologic Changes in the Patients and in the Experimental Monkeys and Rabbits.—A comparison of the pathologic changes in the patient with those in the monkeys and rabbits which had received injections shows considerable similarity. In the patient the changes were generally a little lower in the small intestine, involving more frequently the ileum and a portion of the colon. In the animals the involvement was more frequent in the duodenum and jejunum and in part of the ileum. In the patient the most common findings were a deep reddening of the lower portion of the ileum; a brilliant red and much swollen ileocecal valve; reddened and swollen Peyer's patches near the ileocecal valve, some showing small hemorrhages; a frequently pink and edematous colon, and swollen and reddened mesenteric lymph nodes. In some cases the jejunum showed a reddening of the mucosal folds extending downward to the first portion of the ileum with little or no involvement of the colon. In others the upper part of the ileum showed a pink discoloration, the lower part was deeply reddened and the other involvements mentioned previously were seen.

The microscopic pathologic changes in the patients were: a marked polymorphonuclear and endothelial cellular reaction in the involved portions of the intestinal tract; a diffuse reaction with hypertrophy and central necrosis of lymphoid structures; a swollen and edematous mucosa of the colon, and signs of congestion and toxic changes in all the organs.

In the monkeys which had received injections the entire small intestine was much reddened, the injection being most pronounced in the jejunum. The intestinal contents in the involved portion were purulent and blood-streaked. The adjacent mesenteric nodes were much swollen and a deep reddish purple. Microscopically in the duodenum there were marked mucosal congestion, hemorrhages into the lymphoid nodules and a polymorphonuclear and monocytic reaction. In the jejunum and ileum there was extreme congestion of the mucosa together with a marked acute inflammatory reaction in the mucosa and submucosa.

TABLE 9.—*Incidence of Pathologic Changes in the Intestinal Tracts of Patients and of Monkeys and Rabbits Which Received Injections*

Subjects	Total Number	Number Given Injections	Number Died	Necropsies	Pathologic Changes in Intestine	Streptococci in Intestine
Patients	5	0	5	5	5	4
Monkeys	6	6	5	5	5	5
Rabbits	90	90	64	53	49	36

The colon appeared normal except for slight congestion. The mesenteric nodes showed an acute lymphadenitis and prominent germinal follicles with reticulo-endothelial hyperplasia in their centers. The spleen presented the picture of a severe acute splenitis, showing congestion of the pulp and hemorrhages, necrosis of the malpighian corpuscles and a polymorphonuclear cellular reaction.

In the rabbits which had received injections the pathologic changes were much the same as those seen in the monkeys. The involvement of the intestinal tract was confined to the small intestine, usually to the duodenum, jejunum and first portion of the ileum. Microscopically there were marked congestion of the mucosa, lymphoid hyperplasia, a polymorphonuclear leukocyte and monocyte reaction in the mucosa and diplococci and short chains of streptococci in the mucosa of the jejunum and ileum. In the spleen there were edema and diffuse fibrosis with partial degeneration of the malpighian corpuscles.

SUMMARY OF SECTION II: NECROPSY STUDIES

A brief summary of the necropsy studies (table 9) shows that of five patients studied at necropsy all had gross and microscopic pathologic

changes in the intestinal tract and that Streptococcus micro-apoikia enteritidis was isolated from the intestinal tracts of four patients and from the blood of the fifth. Of six monkeys which received injections of this streptococcus five died, and these showed pathologic changes in the intestinal tract; streptococci were recovered from the intestinal tract of each. Ninety rabbits were given injections, and 70 per cent of these died. Ninety-two per cent of these animals studied at necropsy showed characteristic pathologic changes in the intestinal tract, and cultures of the contents of the intestinal tract of animals at the time of necropsy showed the presence of Streptococcus micro-apoikia enteritidis in 80 per cent.

III. STOOL CULTURES

Dick, Dick and Williams,[8] studying an epidemic of enteritis in infants in which the mortality was 30.7 per cent, found that postmortem material from early cases showed B. coli and green-producing streptococci in the blood streams and in the pus from the mastoids. They also found green-producing streptococci predominating in the throat cultures of ill and well infants and believed that the streptococci isolated from the mastoids were similar to those found in the throats of the ill and well infants. From these findings they concluded, "Since both green-producing streptococci and the colon bacillus are normally present in infants, their presence in the exudates and blood stream at death did not furnish sufficient basis for the assumption that either was the primary cause of the epidemic."

This conclusion is apparently based on the premise that any micro-organism found frequently in normal persons cannot be the etiologic factor in an infection. It is difficult to accept this reasoning. It is a well known fact that certain types of micro-organisms which are ordinarily present in the upper respiratory tracts of well persons may become the causative agents of disease, for example, the rôle of hemolytic streptococci in scarlet fever, otitis media, mastoiditis, meningitis and many other infections, the action of pneumococci in pneumonia and the pathologic changes caused by Bacillus fusiformis and spirochetal organisms.

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8. Dick, G. F.; Dick, G. H., and Williams, J. R.: The Etiology of an Epidemic of Enteritis Associated with Mastoiditis in Infants, Am. J. Dis. Child. **35:** 955 (June) 1928.

8a. Cooper, Merlin, L.; Keller, Helen M., and Johnson, Barbara: Acute Enteritis in Infants and in Young Children: I. Bacteriologic Studies, Am. J. Dis. Child. **47:**388 (Feb.) 1934; II, this issue, p. 596.

As detailed in parts I and II of this article [8a] in the fall of 1931 we observed in infants and young children a number of instances of acute enteritis most of which were preceded by an acute infection of the upper respiratory tract. An intensive study of the bacterial flora of the stools was made, and monkeys and rabbits were given injections of various micro-organisms isolated from the involved portions of the intestinal tracts of these patients, from their stools and from their blood stream. Studies on these patients definitely incriminated a streptococcus which was isolated at necropsy from the involved portions of the intestinal tracts and shown to be present in large numbers. This streptococcus was searched for in all subsequent cultures of necropsy material or specimens of stools, and was used for injection into monkeys and rabbits. We have termed the micro-organism Streptococcus micro-apoikia (small colony) enteritidis.

There was no particular difference between the stools in which the streptococci were found and those from which they were not recovered. The stools in both groups were watery, thin and generally green or greenish-brown; they contained various amounts of mucus, and some in each group showed the presence of blood. Incidentally, blood was not a criterion for the presence of members of the B. dysenteriae group, which were usually absent. Stools which were noticeably mucoid contained the highest percentage of Streptococcus micro-apoikia enteritidis. In this group there were ten specimens of stools which contained these streptococci and five which did not. Of stools which were white or gray three contained the streptococci and three did not. There were but five stools showing gross blood, and two of these contained the streptococci. There were, in addition, twenty stools which did not have any outstanding characteristic, and of these, eleven contained the streptococci.

A total of fifty-one stools from forty-six patients were studied, and Streptococcus micro-apoikia was isolated from 55 per cent.

The bacteriologic methods have been detailed in part I.[8a] Because of the scarcity of these streptococci in such material these methods called for the preparation of several blood agar plate cultures of the stools. It was not an infrequent occurrence to find only one or two colonies of them on three plates of blood agar streaked with one specimen, although later at necropsy they were found in great numbers in the involved portion of the intestinal tracts of the same patients. It is also important to bear in mind that the initial tiny colonies are frequently devoid of the small surrounding area of green. However, on subculture they generally show

the green area around the colonies in the second culture or first subculture from the plate.

Rabbits given intravenous injections of cotton-filtered initial brain broth cultures of the patient's stools which contained a mixture of micro-organism, quickly became ill and dehydrated, lost considerable weight and died in from twenty-four to forty-eight hours. Necropsy revealed marked gross pathologic changes in the first portion of the small intestine. This involved area contained blood-streaked purulent material from which Streptococcus micro-apoikia enteritidis was isolated in pure culture and in great numbers. Such streptococci produced a similar condition in other rabbits and monkeys which subsequently received injections. The details of such animal experiments are given in part IV.[9]

In a few instances streptococci were isolated from stools of rabbits after the direct intravenous injection of a cotton-filtered suspension of the patient's stool. The results were much the same as those previously described, and the streptococci were isolated in pure culture from the contents of the involved portion of the small intestine.

In other experiments saline suspensions of stools or initial brain broth cultures of stools were injected intraperitoneally into mice weighing less than 10 Gm. In some cases the streptococci were recovered from the heart blood, but they were then frequently associated with B. coli.

These various methods of utilizing animals deserve further study, since from the standpoint of therapy it is desirable to develop a rapid method for determining the presence or absence of these particular streptococci in the patients' intestinal tracts.

In table 10 the group of forty-six patients are arranged according to age, together with detailed data regarding the incidence of Streptococcus micro-apoikia enteritidis in the intestinal tracts. The intestinal tracts of five patients were cultured at necropsy, and all contained these streptococci. In none of these five patients was B. dysenteriae found. It is seen that four of these five patients were under 9 months of age. Twenty-eight of the fifty-one stools cultured contained these streptococci. Sixteen of the twenty-eight were from patients under 1 year of age. Sixty-five per cent of the patients studied harbored these streptococci in their intestinal tracts. This figure includes the stool and postmortem cultures. The data also show that thirty-one or 68 per cent of the forty-six patients were under 1 year of age, and of this number nineteen, or 62 per cent, harbored these streptococci in the intestinal tracts. Fifty-nine per cent of the material studied came from patients under 1 year of age.

9. This issue, page 613.

It would be interesting to know how soon after onset of the enteritis the streptococci appear in the stools. Seventy-nine per cent of the positive cultures from stools were obtained during the period of fifteen days following the onset of the enteritis. There were twice as many stools giving positive cultures between the fifth and tenth day after the onset as there were between the first and fifth day, and four times as many as between the tenth and fifteenth day.

Tables 11 and 12 record control experiments in which studies stool cultures were made on forty-nine children who did not have any signs of an intestinal infection. In table 11 are listed twenty-six of these patients who had acute infections such as an acute sore throat, pneu-

TABLE 10.—*Incidence of Streptococcus Micro-Apoikia Enteritidis in the Intestinal Tracts of Forty-Six Patients with Acute Enteritis*

Age	Number of Cases	Deaths	Necropsy		Stools		Patients	
			+	−	+	−	Positive	Negative
0 to 1 mo.	1	0	0	0	0	0	0	1
1 to 3 mos.	7	5	2	0	5	3	6	1
4 to 6 mos.	9	3	1	0	5	4	6	3
7 to 9 mos.	8	3	1	0	5	2	6	2
10 to 12 mos.	6	2	0	0	1	4	1	5
13 to 18 mos.	1	0	0	0	0	2	0	1
19 to 24 mos.	4	1	0	0	2	5	2	2
25 to 30 mos.	2	1	0	0	1	2	1	1
3 to 4 yrs.	2	0	0	0	2	0	2	0
4 to 5 yrs.	2	1	1	0	3	1	2	0
11½ yrs.	1	0	0	0	1	0	1	0
?	3	0	0	0	3	0	3	0
Total	46	16	5	0	28	23	30	16

monia, pyelitis, asthma, otitis media, mastoiditis and pleurisy. Thirty-two stools from these twenty-six patients were cultured for all microorganisms. Twenty-seven stools were free from any type of streptococci. Five stools contained streptococci which differed culturally from Streptococcus micro-apoikia enteritidis. These were from patients with such conditions as ruptured appendix, acute sore throat, acute infections of the upper respiratory tract and asthma. Three of these strains were injected intravenously into rabbits, but only the culture from the patient with asthma caused death in these animals. There were, however, no pathologic changes in the intestinal tracts of the animals which received injections.

In table 12 are listed the remaining twenty-three patients who had no definite infection. They were in the hospital for various conditions such as clubfoot, cleft palate, malnutrition, pyloric stenosis, intussuscep-

TABLE 11.—*Control Experiments: Cultures of Stools from Patients Without Enteritis but with Other Acute Infections*

Diagnosis	Number of Patients	Number of Stools	Streptococci in Stools: Typical	Streptococci in Stools: Atypical	Streptococci in Stools: Negative	Number of Rabbits Given Injections	Number of Rabbits That Died	Necropsy of Rabbits: Number	Necropsy of Rabbits: Pathologic Changes +	Necropsy of Rabbits: Bacteria +
Ruptured appendix	1	1	0	1	0	1	0	0	0	0
Acute sore throat	1	1	0	1	0	1	0	0	0	0
Pneumonia and infection of the upper respiratory tract	7	7	0	0	7	0	0	0	0	0
Pyelitis and infection of the upper respiratory tract	3	8	0	0	8	0	0	0	0	0
Asthma	1	1	0	1	0	1	1	1	0	1
Acute infection of the upper respiratory tract	3	4	0	2	2	0	0	0	0	0
Syphilis	2	2	0	0	2	0	0	0	0	0
Mastoiditis	4	4	0	0	4	0	0	0	0	0
Otitis and infection of the upper respiratory tract	3	3	0	0	3	0	0	0	0	0
Pleurisy	1	1	0	0	1	0	0	0	0	0
Total	26	32	0	5	27	3	1	1	0	1

TABLE 12.—*Control Experiments: Cultures of Stools from Patients with no Definite Infection*

Diagnosis	Number of Patients	Number of Stools	Streptococci in Stools: Typical	Streptococci in Stools: Atypical	Streptococci in Stools: Negative	Number of Rabbits Given Injections	Number of Rabbits That Died	Necropsy of Rabbits: Number	Necropsy of Rabbits: Pathologic Changes +	Necropsy of Rabbits: Bacteria +
Clubfoot	2	8	0	5	3	1	0	0	0	0
Cleft palate	6	13	0	8	5	3	1	1	0	1
Malnutrition	2	3	0	1	2	2	1	1	0	1
Pyloric stenosis	3	8	0	1	7	2	0	0	0	0
Intussusception	1	1	0	0	1	0	0	0	0	0
Growth in larynx	1	4	0	1	3	1	0	0	0	0
Eczema	4	4	0	0	4	0	0	0	0	0
Prematurity	1	1	0	0	1	0	0	0	0	0
Convulsions	1	1	0	0	1	0	0	0	0	0
Stricture of esophagus	1	1	0	0	1	0	0	0	0	0
?	1	1	0	0	1	0	0	0	0	0
Total	23	45	0	16	29	9	2	2	0	2

tion, laryngeal tumor, eczema, prematurity, convulsions and stricture of the esophagus. Forty-five specimens of stools were cultured. Twenty-nine of these did not contain any streptococci similar to those in which we were interested. Sixteen specimens contained streptococci which were not cultural typical of Streptococcus micro-apoikia enteritidis. Nine of these cultures were injected intravenously into rabbits, with only two deaths. One of these occurred when the injected material was from the stools of a malnourished patient, and the other when it was from a patient with a cleft palate. Neither of the two rabbits showed any pathologic changes in the intestinal tract.

TABLE 13.—*Control Experiments: Summary of Stool Cultures from Fifty-Two Patients Without Enteritis*

Source	Number of Patients	Number of Stools	Streptococci			Number of Rabbits Given Injections	Number of Rabbits That Died	Necropsy of Rabbits	
			Typical*	Atypical†	Absent			Pathologic from Streptococci	Some Streptococci in Intestines
Cultures of stools from infants with various infections (not enteritis)	26	32	0	5	27	4	1	0	1
Cultures of stools from infants without acute infections	23	45	0	16	29	9	2	0	2
Total	49	77	0	21	56	13	3	0	3

* Tiny colonies, faintly green, difficult to cultivate and producing pathologic changes in animals given injections.

† Larger colonies, with a larger area of green and not difficult to cultivate; only a few strains virulent; no pathologic changes in animals that received injections.

These control experiments are summarized in table 13, in which results of culturing seventy-seven specimens of stools from forty-nine patients who had no intestinal infection are shown. None of these specimens contained streptococci similar to Streptococcus micro-apoikia enteritidis isolated from patients with enteritis. Twenty-one stools contained atypical streptococci. Thirteen of these strains were injected into rabbits, three of which died but showed no intestinal changes.

It appears, therefore, that stools from patients with acute infections such as those enumerated in table 11 and from patients without acute infections such as those listed in table 12 do not contain streptococci at all similar to Streptococcus micro-apoikia enteritidis found in the intestinal contents of patients with acute enteritis.

During the fall of 1932 we saw only an occasional case of acute enteritis, and we were able to isolate from the stools of only a few of these patients a streptococcus similar to the organisms found the previous year. However, these streptococci when injected into rabbits rarely killed the animals, and in those that did die there were no pathologic changes in the intestinal tract. It is, therefore, proper to believe that different epidemics of enteritis may be associated with various micro-organisms. It is also quite possible that the atypical small colony streptococci occasionally found in stools—organisms which produce less tiny colonies and larger areas of green about the colonies, grow with less difficulty and do not produce pathologic changes in the intestinal tracts of experimental animals—may be confused with the type with which we have been working. Furthermore, it should be emphasized that the streptococcus which appeared nonpathogenic for animals grew in somewhat larger colonies and more luxuriantly, and produced larger surrounding areas of green.

SUMMARY OF SECTION III

1. Streptococcus micro-apoikia was isolated from 55 per cent of fifty-one stools from forty-six patients.

2. The intestinal tracts of five patients cultured at necropsy contained these streptococci.

3. No streptococci similar to Streptococcus micro-apoikia were recovered in the control experiments in which seventy specimens of stools from forty-nine patients who had no intestinal infection were cultured.

IV. EXPERIMENTS ON ANIMALS

INJECTION INTO RABBITS

The observations reported in parts I, II and III [10] on the similarity between the streptococci found in cultures from the throat, in stools and in intestinal tracts (Streptococcus micro-apoikia enteritidis) strongly suggested the relation of this group of organisms to enteritis. The present report presents the experimental results obtained by injection of Streptococcus micro-apoikia enteritidis into rabbits and monkeys.

Rabbits.—Young healthy chinchilla rabbits about 2½ pounds in weight were used. Most of these were kept under observation for two weeks before use. The various materials were injected intravenously. After injection, the animals were placed in individual cages; they were weighed daily, and their temperatures were taken morning and evening. In some instances the blood pictures were studied before and after the injections. When it appeared that the rabbits were

10. Cooper, Merlin L.; Keller, Helen M., and Johnson, Barbara: Acute Enteritis in Infants and in Young Children: I. Bacteriologic Studies, Am. J. Dis. Child. **47**:388 (Feb.) 1934; parts II and III, this issue, pages 596 and 606.

near death, they were killed, necropsies were performed and material was obtained for bacteriologic study. Otherwise they were studied as soon after death as possible. All material for bacteriologic study was obtained under aseptic conditions.

In general the reactions of the rabbits after intravenous injection of Streptococcus micro-apoikia enteritidis were as follows: Within four hours the temperature had increased from 2 to 4 F., this temperature being maintained at least forty-eight hours if the animal survived as long as that. If it survived the infection for a longer time, the temperature gradually became subnormal before death, although, as a rule, death occurred within forty-eight hours. There was rapid emaciation, the animals quickly losing from one third to one half of their body weight. Diarrhea developed in twelve rabbits, this usually occurring the day before death.

Rabbits Given Injections of Original Mixed Culture of Stool or Intestinal Contents.—As an example of this group of studies on animals we may give in detail the experiment with rabbit 207. A patient, E. E. H., aged 4 years, suddenly became acutely ill with pain in the upper part of the abdomen, fever, headache, vomiting and diarrhea. Two days after the onset of these symptoms the child was admitted to the hospital with a temperature of 103 F., tenderness in the epigastrium, vomiting of coffee-ground material, and marked toxicity, and dehydration. While in the hospital he had as many as twenty-six stools in fifteen hours, most of them containing blood and mucus. He had had an acute infection of the upper respiratory tract just before the onset of these symptoms; on admission to the hospital he had a bilateral otitis media and, according to the roentgenologic examination, cloudiness of both mastoid regions. The white cell count on admission was 27,500 with 45 per cent polymorphonuclear leukocytes and 24 per cent lymphocytes. The reactions to the Widal test and a culture of the blood were both negative. A stool was obtained for culture the day after admission to the hospital, or four days after the onset of the illness. Two and one-half cubic centimeters of the original brain broth culture of this stool was injected into rabbit 207. Fever developed within three hours; the animal became very weak and toxic and at the end of twenty-eight hours was in such a bad condition that it was killed. Necropsy was performed immediately. The entire small intestine was hyperemic and injected. In the wall of the first third of the small intestine were numerous areas of various size resembling hemorrhages, and the entire wall was diffusely reddened. The large intestine was not involved. Cultures from the stomach and first third of the small intestine contained only Streptococcus micro-apoikia enteritidis. Cultures from the remainder of the small intestine and from the large intestine did not harbor such streptococci. The blood from the heart was obtained for culture just before this animal was killed, and Streptococcus micro-apoikia enteritidis was found.

These findings represent the results obtained in a group of twenty rabbits given injections of an original brain broth culture of stools from patients. Reference to table 14 shows that seventeen of the twenty rabbits died, that twelve of these seventeen were studied at necropsy and that ten of the twelve showed marked gross pathologic changes

in the small intestine, the detailed description of which has been noted in part II. Streptococcus micro-apoikia enteritidis was recovered from the contents of the involved small intestine in seven of these ten rabbits.

Rabbits Given Injections of Streptococci Obtained from the Blood of a Patient.—The streptococcus obtained by blood culture from a patient with enteritis shortly before his death was used in this and in numerous other experiments, and will be termed strain R. It persisted in growing slowly and only in the presence of blood. It was insoluble in bile and fermented dextrose, saccharose, maltose, raffinose, salicin and lactose, but failed to ferment inulin and mannite. The colonies on blood agar were small, flat, smooth and granular, had even and regular edges and were surrounded by narrow, faintly green halos.

Rabbit 306 was given an intravenous injection of 2.5 cc. of a twenty-four hour old brain broth culture of this streptococcus, one month after isolation from

TABLE 14.—*Rabbits Given Injections of Original Mixed Culture of Stool or Intestinal Contents*

				Intestinal Tracts			Subsequent Injections		
Source of Culture	Number of Injections	Number That Died	Necropsy	Gross Pathologic Changes	Bacteriologic Examination	Streptococci Present	Of Recovered Streptococci	Died	Gross Pathologic Changes in Intestinal Tract
Stool	17	15	10	8	8	6	7	3	3
Intestinal contents	3	2	2	2	2	1	1	1	1
Totals	20	17	12	10	10	7	8	4	4

the patient's blood. The temperature of the rabbit at the time of injection was 102 F. and the weight, 1,590 Gm. Four hours later the temperature was 106 F., and the animal was very toxic. Death occurred early the next morning. On opening the abdomen the entire length of the small intestine appeared extremely injected and hyperemic. The mesenteric lymph nodes were enlarged and highly injected, the more central of these appearing as matted masses of deeply injected glands. The large intestine appeared normal in color, but the contents were soft throughout. The deep red of the small intestine and the similar color and abnormal enlargement of the mesenteric lymph nodes were striking. The contents of the small intestine appeared as thick blood-streaked mucopurulent material. A stained preparation of this material revealed many chains and pairs of streptococci as the only organisms and many polymorphonuclear leukocytes and red blood cells (fig. 2 *A*).

Cultures were made of material from all portions of the intestinal tract and the various organs. Streptococci were recovered from the entire length of the small intestine and the first part of the large. These streptococci were then passed through four additional rabbits in succession, producing similar lesions in all. The microscopic study of the animals' organs showed the following: The sections of the stomach were normal. In the small intestine there were lymphoid

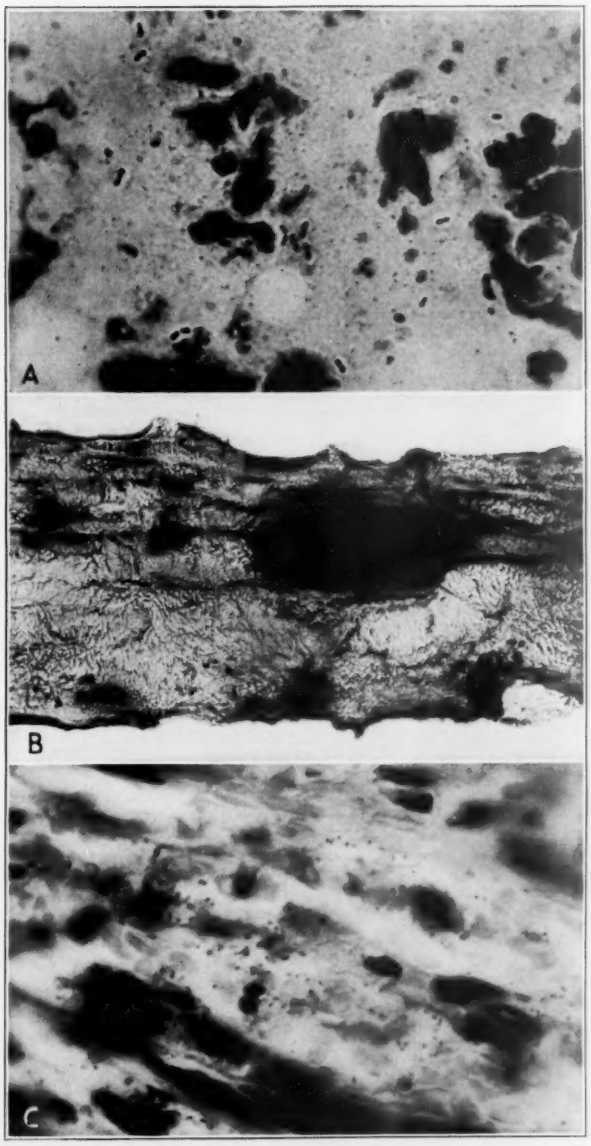


Fig. 2.—*A*, purulent bloody contents of involved small intestine of rabbit 306, showing streptococci and polymorphonuclear leukocytes. *B*, areas of congestion in the wall of the small intestine of rabbit 362. *C*, gram-positive diplococci in the submucosa of the involved small intestine of rabbit 306.

hyperplasia, marked congestion of the mucosa, a polymorphonuclear and monocyte reaction in the mucosa and submucosa and diplococci in the mucosa (fig. 2 *C*). The mesenteric nodes showed toxic changes and the presence of diplococci. The spleen and liver revealed toxic changes. The kidney showed a toxic nephrosis with diplococci and short chains of streptococci in the capillaries of the glomerular tufts. The heart showed congestion and slight toxic myocardosis. A total of twenty-eight rabbits were given injections with this strain, as was rabbit 306. The results are given in table 15.

Rabbits Given Injections of Pure Cultures of Streptococcus Micro-Apoikia Enteritis Isolated from the Stools of Patients.—H., aged 1½ years, had been ill for four days with an acute infection of the upper respiratory tract. Suddenly a high fever, nausea and vomiting developed and the child had from six to eight

TABLE 15.—*Rabbits Given Injections of Pure Cultures of Streptococcus Micro-Apoikia from Patients with Enteritis and Animals Which Had Received Injections*

				Intestinal Tracts			Subsequent Injections		
Source of Streptococci	Number of Injections	Number That Died	Necropsy	Gross Pathologic Changes	Bacteriologic Examination	Streptococci Present	With Recovered Streptococci	Died	Gross Pathologic Changes in Intestinal Tract
Blood of patients	28	26	22	21	17	13	22	21	17
Stool of patients	33	20	15	13	12	9	7	3	3
Throat of patients	7	3	3	2	3	3	2	2	2
Material from necropsy of patients	6	3	3	3	3	1	1	1	1
Intestines of monkey given injections	10	7	6	6	6	6	3	3	3
Mice given injections	6	5	4	4	4	4	3	2	2
Totals	90	64	53	49	45	36	38	31	28

watery-green mucoid stools daily. He became quite toxic but not markedly dehydrated, and after eight days he gradually improved. Three days after the onset of the acute enteritis a specimen of stool was obtained for study. Direct smears revealed a few gram-positive diplococci. Streptococcus micro-apoikia enteritidis was isolated from cultures.

Rabbit 235 was given intravenous injections of only 0.15 cc. of a saline suspension of this streptococcus (H) washed from a blood agar slant culture. Within four hours its temperature had risen to 105 F., and it remained there until the rabbit died the next day. It became toxic and weak and lost considerable weight. The small intestine was deeply injected. The lymph nodes in its wall were enlarged and deep scarlet. The contents were creamy, purulent and blood-streaked. The mucosa appeared much inflamed. Cultures from this involved small intestine and from the liver, spleen and heart contained streptococci.

This experiment is representative of a large number, as illustrated in table 15, which shows the results of injecting into thirty-three rabbits

Streptococcus micro-apoikia enteritidis isolated from the stools of patients, and the results in seven rabbits given injections of Streptococcus micro-apoikia enteritidis isolated from the involved intestinal tracts of inoculated rabbits.

Rabbits Receiving Peritoneal Washings from Mice Given Injections.—In an effort to determine whether the virulence of these streptococci isolated from the stools of patients with acute enteritis could be enhanced, we studied six strains after they had been injected intraperitoneally into mice. When the mice were near death, they were killed and their peritoneal cavities washed out with 1 cc. of physiologic solution of sodium chloride. These washings were injected intravenously into rabbits, and it was found that as little as 0.2 cc. would produce the characteristic pathologic changes in the intestine and death. Such peritoneal washings had a viable bacterial count ten times as great as that of the brain broth cultures. The streptococci were easily recovered from the contents of the involved small intestine. We feel that the use of mice did not result in enhanced virulence, but that the greater number of streptococci accounted for the small amount of culture necessary to produce intestinal lesions and to kill the rabbit.

The experiment on rabbit 362 is an example of a group experiments in which rabbits were given injections of the peritoneal washings of mice previously receiving injections of Streptococcus micro-apoikia enteritidis. Mouse 25 had been given an intraperitoneal injection of the streptococcus strain R. It died within eight hours, and its abdominal cavity was washed out with 1 cc. of physiologic solution of sodium chloride. Only 0.2 cc. of these washings was injected intravenously into rabbit 362, which died nine hours after injection and was studied immediately. The first 12 inches of the small intestine appeared red and contained a small amount of greenish-gray fluid. In its wall were large and small areas of deep congestion (fig. 2 *B*). Culture of this material contained only Streptococcus micro-apoikia enteritidis. The remainder of the small intestine was markedly hyperemic. Cultures of its contents contained only Streptococcus micro-apoikia enteritidis. The large intestine appeared normal, and cultures were negative for this streptococcus. The lymph nodes in the wall of the small intestine were deep purple and enlarged. The mesenteric nodes were enlarged, firm and deeply injected. Cultures revealed a few of the streptococci. Table 15 gives the results of injecting into six rabbits the peritoneal washings of mice which had received intraperitoneal injections of streptococci from the stools of patients with acute enteritis.

Rabbits Given Injections of a Suspension of a Patient's Stool.—The rabbit in the following experiment illustrates another group of studies in which a suspension of a patient's stool was injected intravenously into rabbits for the purpose of producing the specific pathologic changes and recovering the streptococcus as quickly as possible. For the preliminary phase of this study we used for culture the contents from the involved area of the intestinal tract of the rabbit. Rabbit 360 was given intravenous injections of 5 cc. of a cotton-filtered suspension of the contents of the involved small intestine of rabbit 362 previously described. It died within eleven hours and was almost immediately studied. Nearly the entire length of the small intestine was deeply injected, especially the lower two-thirds. The contents of this involved intestine appeared as blood-streaked creamy pus. Cultures of these contents throughout the entire length of the small intestine gave only pure cultures of Streptococcus micro-apoikia enteritidis. Cultures

of the large intestine and rectum were negative for this micro-organism. Cultures of the spleen, liver and brain contained only Streptococcus micro-apoikia enteritidis.

This group of experiments indicated that the method of injecting intestinal contents did result in the production of typical changes in the intestinal tract and marked injection of the intestinal wall together with blood-streaked purulent contents. In the intestinal contents Streptococcus micro-apoikia enteritidis was found in pure culture. It seems that this procedure should be an effective method for determining the etiologic agent in a patient with such an infection, providing the voided stool contained sufficient numbers of the streptococci. Unfortunately, the stools of patients often contain exceedingly few of these streptococci. Additional studies in this connection will be reported later.

Rabbits Given Injections of the Streptococci from Human Material Obtained at Necropsy.—The major gross pathologic changes in patients, experimental monkeys and rabbits, when studied at necropsy, were in the small intestine and mesenteric lymph nodes. The bacteriologic study of these areas nearly always revealed the presence of streptococci. There was no difficulty in reproducing the same pathologic changes after injection into animals, using the same streptococci isolated from the contents of the involved portion of the intestine. In order to make certain that similar streptococci isolated from the mesenteric lymph nodes were able to produce intestinal lesions, they were injected into animals. Rabbit 263 was given an intravenous injection of 5 cc. of a cotton-filtered saline suspension of a mesenteric node from a patient (W. C.) after the node had been thoroughly ground in a mortar. Diarrhea developed within forty-eight hours and persisted for eight days, or until death. During this time there was a high fever, with much loss of weight. A postmortem study of the rabbit revealed the characteristic lesions in the intestinal tract and mesenteric nodes. Microscopic study of sections of the intestinal tract revealed congestion and edema with an increased cellular infiltration, chiefly lymphocytes, most marked in the mucosa of the duodenum. Cultures of the contents of the involved small intestine and the involved mesenteric nodes showed only the presence of these small-colony, green-producing streptococci which, when injected into rabbit 343, reproduced the same pathologic changes. Thus it seems quite certain that the streptococci frequently found in the mesenteric lymph nodes of the monkeys and rabbits that receive injections are the same as those in their intestinal tracts.

Notes Regarding Virulence.—Strain R remained virulent for rabbits and monkeys for five months, during which time it produced the typical pathologic changes in the intestinal tracts of experimental animals. It then suddenly became avirulent and failed to kill rabbits or mice. Most of the strains lost their virulence within a few transplants after the original isolation. Some produced the intestinal lesions only in the first few animals and then became avirulent.

Control Experiments with Rabbits.—Control experiments were made in several ways. (1) Animals were given injections of similar green-

producing, small-colony streptococci derived from patients with conditions other than acute enteritis. (2) Rabbits were given injections of micro-organisms other than green-producing streptococci to determine whether the former instituted pathologic changes in the animal's intestinal tract. (3) Complete bacteriologic studies were made on normal animals in exactly the same way as on the experimental animals in order to determine whether normal animals harbored such streptococci. (4) Rabbits were given injections of B. coli—the only micro-organism found consistently in the stools of patients with enteritis—to determine whether any pathologic changes might be produced in the intestinal tract by them.

1. Seventy-three strains of streptococci, which morphologically and culturally belong to the micro-apoikia group, were isolated from seventy-

TABLE 16.—*Rabbits Given Injections of Streptococcus Micro-Apoikia Isolated from Patients with Conditions Other Than Acute Enteritis*

Sources of Cultures	Number of Strains	Number of Rabbits Given Injections	Number of Rabbits That Died	Observations at Necropsy		
				Number	Pathologic Changes +	Bacteria +
Throats	9	11	4	3	2	1
Stools						
Acute infection	29	4	1	1	0	1
No acute infection	23	9	2	2	0	2
Various sources	12	26	6	4	2	2
Total	73	50	13	10	4	6

three normal children or from patients with conditions other than enteritis. Nine of these strains were isolated from throat cultures of patients with infections of the upper or lower respiratory tract; fifty-two strains were isolated from stools of patients with and without various acute infections, and twelve strains were isolated from various sources such as a ruptured appendix, an excised gland in a case of glandular fever, sputum, pericardial fluid, spinal fluid, blood cultures, empyema fluid, teeth and mastoids. Fifty of these cultures were injected intravenously into rabbits in the same way as in the studies on enteritis.

In table 16 it is seen that thirteen of the rabbits died. These had been given injections of streptococci as follows: four rabbits, organisms from throats; three, from stools; two, from spinal fluid; two, from blood, and two, from mastoids. Ten of these thirteen rabbits were studied at necropsy, and in four, including two given injections of streptococci from mastoids and two given injections of streptococci from

the throats of patients with acute tonsillitis and pharyngitis, the typical gross pathologic changes were found as previously described following the injection of known enteritis strains. Streptococcus micro-apoikia was recovered from the intestinal contents of three rabbits. It is important that of the thirteen strains isolated from stools only three killed rabbits, and that none of these rabbits showed any gross pathologic changes in the intestinal tracts. Thus it is seen that of fifty cultures of green-producing streptococci isolated from various types of cases other than enteritis 74 per cent failed to kill rabbits and only 8 per cent of these cultures produced lesions in the small intestine similar to those produced by streptococci from cases of enteritis. None of these patients had any symptoms of gastro-enteric disturbance, yet the green-producing streptococci from the throats of two and from the mastoids of two produced in the intestinal tracts of rabbits which received injections lesions similar to those produced by Streptococcus micro-apoikia enteritidis from the stools of patients with acute enteritis. The patients with pharyngitis and tonsillitis had acute infections of the upper respiratory tract. The patients with acute mastoiditis had had acute infections of the upper respiratory tract which were subsiding somewhat at the time of the development of the acute mastoiditis.

2. Thirteen rabbits were given intravenous injections of bacteria other than green-producing streptococci, including: three strains of Streptococcus mucosus from patients with meningitis, empyema and septicemia; two strains of hemolytic streptococci from a patient with empyema and from the stool of a monkey; three strains of B. coli from the stools of a rabbit and a mouse and from the stool of a patient with acute enteritis, and B. coli, B. mucosus-capsulatus and a gram-positive bacillus from the trachea of a patient with an acute fatal laryngitis. Nine of these rabbits died; eight were studied at necropsy; the intestinal tracts of all were normal, and micro-organisms similar to those injected were isolated from six.

3. Nine normal rabbits were bled to death; autopsies and cultures were made in exactly the same way as for the rabbits with enteritis. In all of these the intestinal tracts and other viscera appeared perfectly normal. Cultures from the blood, spleen, liver and kidneys were negative for micro-organisms. Cultures from the entire length of the small and large intestine and rectum were free from Streptococcus micro-apoikia but contained B. coli.

4. B. coli was the only micro-organism other than Streptococcus micro-apoikia enteritidis found consistently in the stools of patients with acute enteritis, although it was seldom found in the involved portion of the small intestine either in the patient or in the animal which had

received injections. Its consistent presence in the stools made it advisable to determine the effect of its injection into animals. Four rabbits were given intravenous injections of young brain broth cultures of four different strains of B. coli. One was isolated from the diarrheal stool of a patient with acute enteritis, one from the bronchus of a child dying of acute obstructive laryngitis, one from the involved intestinal tract of a rabbit that had been given an injection and one from the peritoneal fluid of a mouse which had received injections of the original brain broth culture of the stool of a patient with enteritis. The first two cultures killed the rabbits, but there were no gross pathologic changes in the intestinal tract or in any other organ. Cultures from the entire length of the intestinal tracts contained B. coli but no streptococci. (The presence of B. coli in the first portion of the small intestine is unusual in normal rabbits.)

COMMENT ON EXPERIMENTS WITH RABBITS

Table 15 summarizes the results in ninety rabbits given injections of Streptococcus micro-apoikia enteritidis isolated from stools, blood and purulent contents of the involved portion of the small intestines of patients with acute enteritis. Sixty-four or 70 per cent of the ninety rabbits died. Eighty-three per cent of the rabbits which died were studied at necropsy, and 93 per cent of these showed the typical gross pathologic changes in some portion of the small intestine. Streptococci similar morphologically and culturally to those injected were isolated from 80 per cent of the rabbits studied at necropsy.

These reisolated streptococci killed 82 per cent of the rabbits subsequently given injections of them, and they produced typical gross pathologic changes in the intestinal tracts of 90 per cent of those which died.

These results seem to indicate that the streptococi isolated from the involved intestinal tracts of animals which had received injections were the same as those injected.

It appears justifiable to conclude that, with the exceptions to be noted, only green-producing streptococci (Streptococcus micro-apoikia enteritidis) isolated originally from the involved intestinal tracts, blood stream or mesenteric lymph nodes of patients with acute enteritis or those isolated from rabbits, monkeys or mice experimentally inoculated were capable of producing marked gross and microscopic pathologic changes in the small intestines and mesenteric lymph nodes of rabbits and monkeys. The exceptions were the four cases in which similar streptococci from the mastoid cells and throats of patients who had no signs of an enteric infection produced such intestinal lesions.

EXPERIMENTS ON PROTECTION WITH CONVALESCENT SERUM FROM RABBITS

A few rabbits, although very ill after injection of Streptococcus micro-apoikia enteritidis, gradually recovered. The following experiments were conducted in order to determine whether their serums would protect other rabbits against this micro-organism.

TABLE 17.—*Experiments on Protection with Serum*

	Culture				Serum				
Rabbit	Source	Amount	Route	Time and Date	Source	Amount	Route	Time and Date	Results
	Patient (R)	..	....	.....	Rabbit 277	5 cc.	Subcutaneously	1/12/32 3 p.m.	
	↓								
344	Monkey 1, small intestine ↓ Rabbit 338, spleen	5 cc.	Intravenously	1/12/32 5 p.m.	(Previously given injection and survived)	5 cc.	Intravenously	1/12/32 4 p.m.	No marked change
339	Same	4 cc.	Intravenously	1/12/32 5 p.m.	.....	None	.....	.....	1/13/32 died
349	Same	5 cc.	Intravenously	1/20/32 5:15 p.m.	Same	5 cc.	Subcutaneously	1/20/32 3:30 p.m.	No marked change
					Same	5 cc.	Intravenously	1/20/32 4:15 p.m.	
347	Same	5 cc.	Intravenously	1/20/32 5:15 p.m.	Rabbit 154 Normal	4.5 cc.	Subcutaneously	1/20/32 3:30 p.m.	1/23/32 died
					Same	5 cc.	Intravenously	1/20/32 4:15 p.m.	
350	Same	4 cc.	Intravenously	1/20/32 5:15 p.m.	.....	None	.....	.....	1/22/32 died

Rabbit 277 was the source of the convalescent serum. It had been given an intravenous injection of 5.5 cc. of a young brain broth culture of streptococci isolated from the washed and ground small intestine of rabbit 274. The latter rabbit had received an intravenous injection of 1 cc. of a saline suspension of strain R washed from a blood agar slant. Rabbit 277 became ill, but survived the first injection; twelve days later it was given an injection of 3 cc. of a brain broth culture of strain R. It again became quite ill with a temperature of from 106 to 107 F., and over a period of three days lost 400 Gm. It then gradually recovered. Two months later its serum was used in the following experiments on protection.

Reference to table 17 shows that five rabbits were used in this experiment. Two were given two doses each of 5 cc. of convalescent serum from rabbit 277

two hours and one hour respectively before receiving injections of the culture. Another rabbit was treated in the same manner, except that it received two injections of serum from a normal rabbit. Two other rabbits received no serum. All five rabbits were given injections of the R strain. The only rabbits which survived were the two which had received the convalescent rabbit serum. The temperature of rabbit 344 rose to 105 F. for three days, but no marked variation in the white cell count and no abnormal reaction occurred. Rabbit 349 lost 125 Gm. in the eight days following the injection, and during that time its temperature varied between 104 and 106 F., and its white cell count between 6,000 and 12,000 per cubic millimeter. Its weight then increased, and it remained normal. Both of these rabbits remained in a normal state for five months; after that time they were used in another experiment.

The three unprotected rabbits became ill within four hours after the injection. Rabbit 347, which had received an injection of the normal rabbit serum, lost 100 Gm. before death; its temperature remained constantly between 105 and 106 F., and its white cell count dropped from 6,000 to 2,300. Rabbits 339 and 350, which did not receive any serum, had temperatures ranging between 106 and 108 F., and the white cell count of rabbit 339 dropped from 12,000 to 6,300, while that of rabbit 350 fell from 5,000 to 3,000. Each lost 200 Gm. in weight and died on the second day. The pathologic changes in rabbit 339 were in the ileum and jejunum, while in rabbit 350 they were in the ileocecal region.

The results of this preliminary experiment indicated that the blood serum of a rabbit which had survived an acute infection with Streptococcus micro-apoikia enteritidis gave protection to other rabbits sufficient to enable them to withstand a dose of the streptococci which killed and produced characteristic pathologic changes in unprotected rabbits. Normal rabbit serum was devoid of this protective power.

INJECTION INTO MONKEYS

The experiments on injections into monkeys were entirely similar to those performed with rabbits. Changes in the white cell counts, temperatures and weights were carefully noted. The white cell count increased sharply shortly after the injection, but soon returned to near its former level about which it fluctuated in an irregular manner. It generally declined as the temperature went up; it was always high when the diarrhea made its onset, and it usually increased just before death. The temperature was always elevated following the injection; it was generally on the decline when the diarrhea occurred, and it was approaching normal at the time of death. The weight fell suddenly following injection, took a further drop during the period of diarrhea and fell markedly just before death. The diarrhea occurred at any time up to eight days, but usually began one or two days, after injection.

As examples of the results of injecting Streptococcus micro-apoikia enteritidis into monkeys we cite in detail the observations made on monkeys *7* and *2*.

Monkey 7, a Macacus rhesus, was given an intravenous injection of the pooled peritoneal washings of five mice which had received injections of strain R. Its temperature increased from 102 to 104 F. within two hours, and after seven hours it was ill, restless and paid no attention to visitors. At the end of seventeen hours it was so weak that it lay on the floor of its cage, and could not be aroused. It died about eighteen hours following the injection. Necropsy was immediately performed. The entire small intestine was deeply injected. In the second 6 inches there were numerous large deep red areas of congestion which had much the appearance of gangrenous tissue. The contents of this area were thick, bloody and purulent. The second 12 inches was in a similar condition except that there were no areas of congestion. The contents of the remainder of the small intestine were thick and pale yellowish green. The mesentery was injected; its vessels were engorged, and its lymph nodes enlarged and deep red. Cultures of the mesenteric nodes and the entire small intestine contained many of the streptococci, and cultures of the first half of the large intestine, a few.

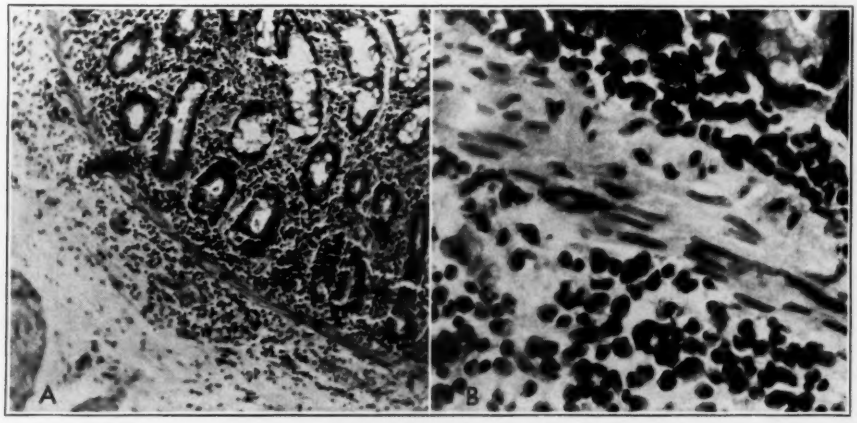


Fig. 3.—*A,* congestion and cellular reaction in the mucosa with cellular reaction in the mucosa. Low power magnification. *B,* polymorphonuclear and monocyte reaction in the mucosa and submucosa. High power magnification.

Figure 3 illustrates the pathologic changes in the small intestine. The duodenum showed mucosal congestion, hemorrhages into the lymphoid nodules, polymorphonuclear and monocytic reaction in the mucosa and hemorrhage between the duodenal wall and the pancreas. In the sections of the jejunum there were extreme congestion of the mucosa and an acute inflammatory reaction in the mucosa and submucosa—an acute enteritis. The colon was normal except for slight congestion. Sections of the mesenteric nodes revealed acute lymphadenitis and prominent germinal follicles with reticulo-endothelial hyperplasia in their centers. Section of the spleen showed severe acute splenitis, congestion of the pulp with some hemorrhage and necrosis of the malpighian corpuscles with a polymorphonuclear reaction. The stomach and spinal cord were normal. There was slight cerebral edema. The liver showed vacuolation of many of its cell nuclei. The kidneys gave the picture of a toxic nephrosis. In the lungs there were congestion and edema. The heart showed slight toxic changes.

Monkey 2, also a Macacus rhesus, weighing 1,870 Gm., was fed over a period of two weeks a total of 540 cc. of a heavy suspension of Streptococcus micro-apoikia enteritidis isolated from the stool of a patient with severe and typical acute enteritis. The animal was unaffected, and at intervals of six weeks, one month, and eight days respectively it was given injections of increasingly larger quantities of young broth cultures of strain R. It recovered from the first two injections, although temporarily ill, but the last injection of 20 cc. resulted in its death after three days. The pathologic findings in its intestinal tract and mesenteric lymph nodes were typical and similar to those previously described for monkey 7. In addition there was a recent intussusception in the lower part of the jejunum. The fact that it required three increasingly large doses of the streptococci to kill this monkey suggests that feeding the culture previously may have influenced its susceptibilty.

In table 18 are shown experiments with six Macacus rhesus monkeys which received intravenous injections of streptococci from patients with

TABLE 18.—*Monkeys Given Injections of Streptococcus Micro-Apoikia Enteritidis from Patients with Acute Enteritis*

Monkey	Ill	Streptococcus in Stools After Injection	Diarrhea	Died	Pathologic Changes in Intestines	Streptococci in Intestines
1	Yes	Yes	Yes	Yes	Yes	Yes
2	Yes	No	Yes	Yes	Yes	Yes
3	Yes	Yes	Yes	No		
4	Yes	Yes	Yes	Yes	Yes	Yes
6	Yes	Yes	No	Yes	Yes	Yes
7	Yes	Yes	Yes	Yes	Yes	Yes
Total	6	5	5	5	5	5

acute enteritis. These streptococci had previously produced intestinal lesions and death when injected into rabbits. All six monkeys became ill, and five died. These five showed marked lesions in the small intestines similar to those described in the experiment with monkey 7, and from the intestinal contents the same streptococci were recovered in each instance. These reisolated streptococci produced similar lesions when subsequently injected into rabbits. Following injection into five monkeys the same streptococci were recovered from the stools, which had been negative for such micro-organisms previous to injection. Severe diarrhea developed in five of the monkeys.

Rabbits Inoculated with the Streptococci Reisolated from the Stools of Monkeys Which Had Received Injections.—Cultures of stools of the monkeys before injection did not contain streptococci but, as stated, after injection the organisms were found in the diarrheal discharges. It was important to know whether these streptococci were the same as those injected. Since the production of characteristic intestinal lesions

following the injection of these streptococci is the most certain means of identification, streptococci recovered from the stools of monkeys which had received injections were injected into ten rabbits. Seven of these died. Six were studied at necropsy. All six showed the characteristic gross lesions in their intestinal tracts, and the same streptococci were isolated from all. This group of experiments indicated that the streptococci which appeared in the stools of the monkeys subsequent

TABLE 19.—*Experiments with Berkefeld Filtrates*

Rabbit	Berkefeld Filtrate: Source	Berkefeld Filtrate: Amount	Berkefeld Filtrate: Culture	Route of Injection	Effect on Rabbits
244	Broth culture of streptococci from stool of patient (H)	5 cc.	Negative	Intravenously	Slight initial elevation of temperature; otherwise normal
377	Peritoneal washings of mouse 26 (R)	2.5 min. washings + 7.5 cc. saline ↓ 5 cc. filtrate	Negative	Intravenously	Same
420	Intestinal contents of rabbit 360-R and rabbit 362-R	10 cc. contents + 20 cc. saline ↓ 10 cc. filtrate	Negative	Intravenously	Remained normal
180	Intestinal contents of Rabbit 362-R	Contents * ↓ 4 cc. filtrate	Negative	Intravenously	Remained normal
417	Peritoneal washings of mice 52-59	Washings + 6.5 cc. saline ↓ 6.5 cc. filtrate	Negative	Intravenously	Slight initial loss of weight; otherwise normal
418	Centrifugated sediment of peritoneal washings of mice 52-59	Resuspended to original volume with 1 cc. saline	Streptococci	Intravenously	Death in 21 hours; pathologic changes and streptococci in small intestine

* Seitz filter used in this instance.

to intravenous injection had the ability to produce the same intestinal lesions in rabbits as the streptococci which were injected into the monkeys.

EXPERIMENTS WITH BERKEFELD FILTRATES

The animals which received injections, especially the monkeys, presented a picture of overwhelming toxemia. Certain filtration experiments were conducted in order to obtain some information regarding the nature of this toxin, whether or not it was exotoxin, and its source. By means of Berkefeld filtrates we performed tests for its presence in the following: a brain broth culture of streptococci from the stool of a

patient (H.) with acute enteritis; peritoneal washings of mouse 26, which had received injections of streptococcus strain *R*; purulent intestinal contents of rabbits 360 and 362; the pooled peritoneal washings of mice 52 to 59 inclusive.

Reference to table 19 shows that all of these filtrates failed to cause disturbance in the rabbits which received injections except for a slight initial elevation of temperature and a slight loss of weight. These results do not rule out the presence of toxin in the material tested. They do indicate, however, that it did not contain sufficient toxin to account for the changes observed in the animals after injection, and it should be noted that the respective sources of the filtrates produced marked pathologic lesions in the intestinal tracts and death in the animals which received injections.

SUMMARY OF SECTION IV

I. *Experiments with Rabbits.*—1. Rabbits which received injections of the original mixed culture of stools or intestinal contents died; typical lesions were found in their intestinal tracts, and from these areas Streptococcus micro-apoikia enteritidis was recovered.

2. Rabbits which received injections of pure cultures of streptococci from the blood, postmortem material or stool of the patients, from a suspension of a patient's stool, from the peritoneal washings of mice which had received injections or from rabbits that had been given injections showed the same typical pathologic changes in their intestinal tracts, and from these areas the streptococci were recovered.

3. Organisms from rabbits which received injections of somewhat similar green-producing streptococci isolated from stools and other sources in patients free from any enteric infection were but slightly virulent, and in only a few instances did cultures produce intestinal lesions. These cultures were from the throats of two patients with acute pharyngitis and from the mastoid cells of two other patients with acute mastoiditis.

4. Streptococcus micro-apoikia enteritidis was not found in the intestinal tracts of normal rabbits studied at necropsy.

5. Convalescent rabbit serum protected rabbits against Streptococcus micro-apoikia enteritidis.

6. Rabbits remained normal when given injections of Berkefeld filtrates of cultures of streptococci recovered from patients with acute enteritis, of the bloody purulent contents of the involved intestine or of peritoneal washings of mice that had been given injections.

II. *Experiments with Monkeys.*—1. Six Macacus rhesus monkeys were given injections of streptococci recovered from patients with acute enteritis. The six monkeys became ill, and five died. All five showed

typical lesions in the small intestines, and the streptococci were isolated from the contents of these areas. These reisolated streptococci produced the same lesions in the intestinal tracts of rabbits. Cultures of stools of the monkeys before injection did not contain these streptococci, but the organisms were present in cultures of the diarrheal stools after injection.

III. *Pathologic Changes.*—1. Generally, the first third of the small intestine of the rabbit or the major portion of the small intestine of the monkey appeared deeply injected. The lymphoid tissue in the wall of the involved portion of intestine was enlarged and purplish red. The contents of this portion of the intestine were blood-streaked, thick and purulent. The nodes in the mesentery, especially those adjacent to the intestine, were enlarged and deeply purple.

2. Microscopic study of sections of the small intestine revealed marked congestion in the mucosa, a polymorphonuclear and monocyte reaction in the mucosa and the submucosa and diplococci in the mucosa. Sections of mesenteric nodes revealed acute lymphadenitis and prominent germinal follicles with reticulo-endothelial hyperplasia in their centers. Sections of the spleen showed severe acute splenitis, congestion of the pulp with some hemorrhage and necrosis of the malpighian corpuscles and a polymorphonuclear reaction. The liver showed vacuolation of many of its cell nuclei. The kidneys gave the picture of a toxic nephrosis. Other tissues were normal.

GENERAL SUMMARY

1. Each of the four sections of this paper has its individual summary.

2. The summary of section I deals with thte bacteriologic methods and the morphologic characteristics of Streptococcus micro-apoikia.

3. The summary of section II reports the clinical and necropsy observations.

4. The summary of section III gives the results of bacteriologic studies of stools and intestinal contents.

5. The summary of section IV comments on the pathologic changes in monkeys and rabbits receiving injections of Streptoccocus micro-apoikia.

Pediatric Biographies

RICHARD MORTON, M.D.
1637-1698

A NOTE ON THE HISTORY OF CHYLOUS ASCITES

JOHN RUHRÄH, M.D.
BALTIMORE

Richard Morton, the author of the well known "Phthisiologia, seu exercitationes de phthisi," deserves a place in the ranks of the early pediatrists, for he was perhaps the first to describe the condition of chylous ascites in early life, and he not only reported a case with autopsy but made the diagnosis during life—no mean feat in those days, or in these either, without using methods which Morton did not have at his command.

Morton, a contemporary of Sydenham, is an interesting figure in medicine. He was born in 1637 and matriculated in 1654 as a commoner in Magdalen Hall at Oxford, but later changed to New College, from which he received his A.B. degree in 1657 and his M.A. degree in 1659. Soon after he got his first degree he was chaplain to his college, and later he was a chaplain in a wealthy family and was given the living at Kinver in Staffordshire, but as he was unable to comply with the Act of Uniformity, he was relieved of this position. He then began the study of medicine. He received his M.D. degree at Oxford on the nomination of the Prince of Orange in 1670, and settled in London where, in 1679, he was made a Fellow of the Royal College of Physicians and incorporated at Cambridge on his doctor's degree in the following year. He served several times as Censor of the College and was one of the physicians in ordinary to the king. He lived in London in Grey Friars Court, Newgate Street, and when he died in 1698 he was buried in the middle aisle of Christ Church, Newgate Street.

His portrait was painted by B. Orchard, and Elder's engraving of this portrait appears in some of his books. The English editions have a portrait painted and engraved by R. White. Morton wrote two books and some other articles in addition to his "Phthisiologia," which is based on his own experience and observations and makes interesting reading. He used the word "phthisiologia" in a very broad sense and included under it not only tuberculous conditions but wasting from any cause. The book appeared in Latin in London in 1689 and 1696; in Frankfort in 1690; in Ulm in 1714, and in Helmstadt in 1780. The English editions appeared in London in 1694 and 1720. His *Πυρετολογία*: seu exercitationes de morbis universalibus acutis,"

appeared in London in 1692 and 1693, and in Bern in 1693. A second part called "Πυρετολογία. Pars altera: sive exercitatio de febribus inflammatoriis universalibus" was published in Bremen in 1693 and in London in 1694. Among the cases reported in this work, he included an account of an illness he had in 1690.

It would lead too far afield to consider anything but Morton's account of chylous ascites, but it must be mentioned that he was one of the first, if not the first, to advocate fresh air in the treatment of consumption. He said: "Sixthly, let the Patient enjoy an open, fresh kindly Air, and such as is free from the smoak of Coals, which may not

Portrait of Richard Morton, painted and engraved by R. White.

only cherish the Animal Spirits, and comfort the Nervous Parts, and consequently restore the weak Appetite, but likewise procure quiet (at least in some measure) to the Lungs."

The following excerpt is taken from the excellent translation made by S. Smith and B. Walford and published in London in 1694:

A HISTORY

The Son of *Thomas Lechmere,* Esq; being about two Years, and breeding of his Teeth, fell into an Inflammation of his Lungs upon taking of cold, and was treated very ill by an Apothecary, who had omitted Bleeding, and other things, that were very requisite to a true and skilful Method of Cure. But at length I and my Famous Colleague *Dr. Croon,* though we were called in late, recovered him in some measure, by taking away some Blood, and the application of Blisters, and Liniments, that were convenient for his Breast, as also by giving inwardly such Medicines as were proper for his Lungs; But yet he continued sickly with

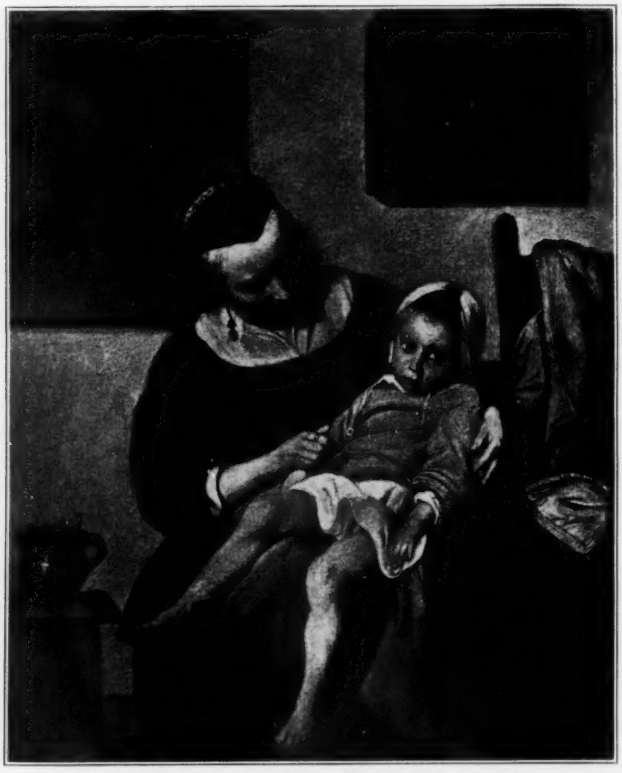
a Cough and difficulty of Breathing, for the space of a Twelve Month at least, from which time the poor Child began to be seized with a Hectick Fever, which intermitted every day, which although it was several times taken off with the *Peruvian Bark,* yet soon return'd again, and indeed came upon him by uncertain intervals for a whole Year, even to his dying day. But at the very beginning of the Fever his Belly began to be distended with a Dropsical swelling, which increased strangely every day; his Cough and shortness of Breath at the same time growing worse: All which Symptoms were at length accompanied with an *Atrophy* of the Parts, even to the degrees of a *Marasmus.* But yet when his Body was a perfect *Skeleton,* and the *Dropsie* at a high Tide (which was very remarkable) he had a brisk and healthful look, and a lovely Countenance, without the least Tincture of a Yellowness, and a good, or rather greedy Appetite, and that to the very day he dyed. From whence I did rightly conjecture, and always told his Friends, as my Opinion, that his Dropsie was truly Chylous, caused by the Chyle flowing into the cavity of the Belly by the Lacteal Vessels, which were broke by some Accident and that the Consumption which accompanied it was not a true Consumption of the Lungs, but such as proceeded merely from an inanition, that is, the draining of the due Nutritious Juice out of the Lacteal Vessels, upon some rupture that had been made in them; which appeared very plainly from the Event. For in Tapping of the Child's Belly, whilst he was yet alive, we took out several Pints of Milky Chyle, and very sweet, such as is found in the Duct it self, which conveys the Chyle. But when we opened the Body after he was dead, we found for all the difficulty of Breathing, and long Cough he had had, the Lungs themselves sound, without any Distemper, but only that in the hinder part near the Wind-Pipe there appeared a great many Glands, and those pretty large and hard, which made a hard and very considerable pressure upon the Chyle-duct it self, almost in that Part where it arrives at the *Subclavian Vein;* and they were of so great a weight and bulk, that it seemed very difficult, if no plainly impossible for the Chyle to pass into the Blood by reason of the pressure they had made upon the Duct, which had straightened it, as if it had been tied with a string. And thereupon without doubt it came to pass that the tender and thin Lacteal Vessels which are in the Belly (the Chyle continually pressing, and not finding a free passage above by the Chyle-duct) being distended beyond their Tone, did at length break, and so threw the Chyle, which was design'd for the reparation of the Blood, as it were in a continued stream into the cavity of the Belly. From what I have now said, it is plain almost to a demonstration, first, that these *Tubercles,* or tumify'd Glands of the Lungs did at first proceed from the ill Method of Curing the Inflammation of his Lungs; that is, for want of timely Bleeding and Expectoration. Secondly, that as the troublesome and dry Cough was caused by the constriction of the Vessels of the Lungs, which convey the Air, by these swellings, so the difficulty of Breathing proceeded from the pressure of the extravasated Chyle below the Midriff. Thirdly, that this Consumption was not a true Consumption of the Lungs; because tho' there were *Tubercles* or Swellings in the Lungs, yet they were not like Apostemes, nor Ulcerated. But this desperate Consumption did really proceed from that *Chylous* Dropsie, upon which that Nutritious Juice, which ought to have been employ'd for the reparation of the Blood, and the Nutrition of the Parts, was continually substracted, and carried another way. Fourthly, that this *Dropsie* did proceed from a rupture of the small Lacteal Vessels that are in the Belly; and lastly, that this rupture of the small Lacteal Vessels was caused by that continual pressure, which the swellings in the Lungs had made upon the upper part of the Chyle-duct.

Pediatrics in Art

GABRIEL METSU'S SICK CHILD

JOHN RUHRÄH, M.D.
BALTIMORE

One of the best known pediatric pictures is that called "The Sick Child" by Gabriel Metsu, which hangs in the Steengracht Collection in The Hague. It represents a mother with her sick child on her lap. The mother's expression is one of quiet solicitude, while the child reclines in her arm in a fairly well relaxed position—a picture frequently



Gabriel Metsu's portrait of a sick child.

seen by the practicing pediatrician. The child evidently has a fever, and from the expression one might hazard a guess that the cause was an upset intestinal tract. Gabriel Metsu (1630-1667) was a Dutch painter, born at Leyden and a pupil of Gerard Dow. Two years after he was admitted to the Painter's Guild of his native city, he moved to Amsterdam, where he spent his life. The photograph is by Bruckmann of Munich.

News and Comment

GENERAL

American Board of Pediatrics.—On January 13, the American Board of Pediatrics, Inc., met in St. Louis and adopted by-laws and rules and regulations for certification. The following officers were elected: Borden S. Veeder, president; Henry F. Helmholz, vice-president, and C. Anderson Aldrich, 723 Elm Street, Winnetka, Ill., secretary and treasurer. The entire membership, which was announced in the December, 1933, issue of the AMERICAN JOURNAL OF DISEASES OF CHILDREN, was present. The following classification of groups for purposes of certification was decided on:

Group I. Physicians who have limited their practice to pediatrics for over ten years. Until September, 1936, suitable applicants may be certified on record, although examination is optional with the Board. After September, 1936, all candidates for this group will be required to take an examination.

Group II. Physicians who have limited their practice to pediatrics for from six to ten years. Applicants must submit evidence of at least one year's hospital training and one year's training in a recognized pediatric center and of continued work in some form of pediatric organization or institution. Examination is required.

Group III. Graduates of five years or less. Applicants must submit evidence of having finished one of the following forms of training: A. One year's service in a general hospital with two years' service in a pediatric center, or three years' service in a pediatric center. B. Two years' service in a pediatric center plus two years' specialized practice in pediatrics, including continued work in some pediatric activity. C. One year's service in a general hospital, one year's service in a pediatric center plus three years' service in the specialized practice of pediatrics, including connection with some pediatric activity. Examination is required on all applicants in this group.

The Board defines service in a pediatric center as full time devoted to rounded experience in an acceptable hospital, or a graduate course which includes ward and outpatient service, including therapeutic and preventive pediatrics. The time served in pediatric centers need not be continuous or spent in the same institution. The fee for certification was placed at $20. This is less than half of the fee charged by examining boards for the other specialties and may have to be increased. A booklet is being prepared containing details, and as soon as it is published it will be sent to every member of the American Pediatric Society and the American Academy of Pediatrics. There is no continuing or membership list of the Section of Pediatrics of the American Medical Association. Pediatricians who are not members of the two societies should apply to the Secretary for a copy.

It should be kept in mind that the American Board of Pediatrics is not a medical society. It was founded by action of the three national pediatric societies mentioned and is controlled by them, as each appoints three members to the Board. The Board, therefore, is merely the agent of the three national societies and its sole function is to issue certificates of proficiency in pediatrics. There are no dues. The certification fee is to pay for the actual work of the Board. According

to the articles of incorporation no member of the Board may receive any salary, bonus or emolument of any kind. On Feb. 11, 1934, "The Advisory Board on Medical Specialties" was organized at a meeting in Chicago. The following organizations are included in the Board (each organization appoints two members to this board): American Board of Ophthalmology, American Board of Otolaryngology, American Board of Obstetrics and Gynecology, American Board of Dermatology and Syphilology, American Board of Pediatrics, Council on Medical Education and Hospitals of the American Medical Association, Association of American Medical Colleges, National Board of Medical Examiners, Federation of State Medical Boards of the United States of America and American Hospital Association. Boards are in process of formation in radiology, orthopedic surgery, gastro-enterology, proctology and psychiatry.

Obituaries

ALFRED FABIAN HESS, M.D.

Alfred Hess died suddenly at the age of 58, on Dec. 5, 1933, after having addressed, as was his regular, annual custom, the class graduating in nursing at the Home for Hebrew Infants in New York, which he made famous throughout the world by his studies of the causes, symptoms, cure and prevention of a variety of diseases and pathologic conditions.

The passing of Alfred Hess removes from the front rank of investigators in the science of medicine, and particularly of pediatrics, a distinguished physician, an outstanding student, a finished scholar, a prolific author, a keen observer and a great hunter for scientific truths.

Alfred Hess was most fortunate. His wife, formerly Sara Strauss, daughter of Mr. and Mrs. Isidor Strauss, for many years was a most exceptional and helpful partner, arranging and managing most of the daily routine matters, acting also virtually as an executive secretary and being understandingly interested in his work, ambitions and tribulations and willing and competent to aid him at all times. She was also a devoted wife, a successful mother and a most charming and cultured hostess. Alfred Hess was well cared for materially, so that he did not need to be concerned with the practice of medicine as a means of livelihood. He fully appreciated the value of, the need for, and the pleasure and satisfaction in, the scientific approach to problems of pathology, physiology and hygiene in pediatrics. He possessed, in an unusual degree, the qualities that enable some investigators to dig deeply to the roots of problems, namely, intuition, imagination, learning, courage, patience, logic, resourcefulness, industry and perseverance. He was unencumbered by the distractions of a large private practice and by the arduous duties and exacting responsibilities of an American professor of pediatrics and, as a result, had time for reflection and relaxation, an asset of inestimable value.

How disappointed Alfred Hess was in not having been chosen to occupy one of the chairs of pediatrics, vacated or created, in this country during the past decade and a half, I do not know, but I am certain that his philosophic attitude toward life and fate made it easy for him not to let such developments disturb his equanimity and blur his vision. The wisdom he possessed evidently enabled him to appreciate that there are more roads than one to creative and successful working and living.

Alfred Hess could have led a life of leisure, comfort and distinction; instead, he chose to use his ability, time and funds to contribute to the

progress of the sciences of medicine and biology in pediatrics by furthering the understanding of diseases and biologic phenomena and by applying the knowledge obtained for the benefit of mankind, particularly in the field of preventive medicine. The course he pursued, after having made practically simultaneously with, but independently of, Steenbock, the brilliant discovery that powerful antirachitic properties could be imparted to certain oils by exposing them to the rays produced by the quartz mercury vapor arc lamp, best portrays his intelligence, wisdom and generosity and establishes his greatness, both as a scientist and as a benefactor of mankind. Instead of being satisfied with this achievement, he was interested in knowing how the oils acquire this biologic quality, and when he finally found in 1925 that neither he nor his colleagues in pediatrics, chemistry and physics in this country could obtain a satisfactory answer, he presented the problem to Professor Windaus of Göttingen, the outstanding student of the chemistry of sterols, only to receive a disinterested reply. In the summer of 1926, after a lapse of many months, being still convinced that his question could be answered, he again approached Professor Windaus and gave him the results of the work that he himself had carried on in the meantime and urged him to undertake the investigation, this time with success. As a consequence of this intelligent perseverance, Alfred Hess made it possible for Professor Windaus to discover that ergosterol was the substance responsible for making cholesterol antirachitic after exposure to the ultraviolet rays and, on the basis of this work, to receive the Nobel prize.

Alfred Hess was a keen observer and, as a result, recognized symptoms that either had gone unnoticed or had been so little emphasized in the literature that they virtually did not exist for the student of medicine and pediatrics. The cardiorespiratory syndrome and the increased permeability of the capillaries in infantile scurvy can serve as illustrations of the successful application of his powers of clinical observation. Paradoxical as it may seem, this most valuable faculty was responsible for his not recognizing the antirachitic efficacy of the rays produced by the quartz mercury vapor arc lamp, with the result that he missed the opportunity, which he deserved, to establish the fundamental etiology of infantile rickets. In this study he chose as the most reliable criterion of the course of the disease the beading of the ribs, and consequently concluded that even though the infants had been exposed to the quartz mercury vapor arc lamp regularly for three months, sufficiently to "brown" them well, the rickets was not benefited, since the beading became worse or at least more prominent, as it is now known to do for some time after the beginning of healing. This investigation was made in the spring of 1917, two years before Kurt Huldschinsky unquestionably established the marked antirachitic power of the quartz mercury vapor arc lamp by using as his criterion the changes in the bones as demonstrated roent-

genographically. It is a strange coincidence that I should have first met both Alfred Hess and Kurt Huldschinsky at the same place, the Kaiserin Auguste Victoria Haus at Charlottenburg, at different times, long before they became interested in the problem of rickets. The friendships which began with these contacts have been enduring and invaluable.

How indefatigable Alfred Hess was in his investigative labors can be seen from the facts that his contributions to the literature number

ALFRED FABIAN HESS

226, and that his subjects covered a wide field. His first publication was made in 1905, and his last was in press at the time of his death. During the period from 1905 to 1911, he was concerned principally with bacteriologic studies; from 1911 to 1914, with physiologic studies of the gastro-intestinal tract; from 1914 to 1919, with the studies of blood dyscrasias, scurvy, active immunization against a number of contagious and infectious diseases and the institutional care of tuberculous and nontuberculous infants. During this period his intensive interest in vitamins began. From 1919 to 1922, he was principally concerned with the study of rickets and of heliotherapy, both natural and artificial; from 1922 to 1924, with a continuation of his work on rickets and light

and with infant feeding; from 1924 to 1926, with investigations on the irradiation of oils and of foods; from 1926 to 1928, with the studies of irradiated ergosterol and monochromatic light; from 1928 to 1930, with studies of the vegetative nervous system and the glands of internal secretion in their possible rôles as transmitters or transformers of the antirachitic factor in the body, and of the relative potency of irradiated ergosterol and cod liver oil, and from 1931 to his death, with further observations on rickets, particularly in connection with the relative antirachitic value of cod liver oil, irradiated ergosterol, irradiated milk and "yeast" milk, and with dental caries, the minerals of human milk and of cow's milk, etc.

Alfred Hess wrote two books, both of which won him renown; one was on scurvy and the other on rickets, osteomalacia and tetany. Although they are not encyclopedic, both books are comprehensive and give, particularly from the historical side, valuable information in a delightful fashion, making them distinctly personal.

Alfred Hess was signally honored on numerous occasions. In 1921, he gave the Cutter Lectures at Harvard University and also a Harvey Society Lecture in New York; in 1926, he gave the address at the opening of the Babies and Childrens Hospital of Cleveland; in 1927, he received the John Scott medal in Philadelphia, with the following citation: "For a method of producing a vitamin factor in food by ultraviolet light." In 1930, he was given the honorary degree of doctor of science at the University of Michigan and made the principal address at the opening of the International Congress of Pediatrics which met in Stockholm during August of the same year, his subject being "The Biological Effect of Direct and Indirect Ultraviolet Irradiation." In 1931, he received the Joseph Mather Smith prize, with the following citation: "For fundamental work in the nutritional diseases of children, with particular reference to scurvy and rickets and for devising a method of producing a vitamin factor in food by means of ultraviolet rays," and he was made Ehrenmitglied der Deutschen Gesellschaft für Kinderheilkunde. During 1933, he gave the Ingleby Lectures at the University of Birmingham, England. From 1927 to 1932, he was a member of the Library Committee of the New York Academy of Medicine and was chairman of the committee in 1932. At the time of his death he was president of the Harvey Society of New York and would have finished his second year in this office during the coming month of June.

Alfred Hess graduated from Harvard University with the degree of bachelor of arts in 1897, and from the College of Physicians and Surgeons, Columbia University, with the degree of doctor of medicine in 1901. Beginning June, 1901, he served a rotating internship of two and one-half years at Mount Sinai Hospital, and after a short holiday, beginning January, 1904, during which he visited Greece and Italy, he

studied medicine in Berlin and in Dresden. He also spent some time in Praha studying pathology under Chiari and six months in Vienna studying clinical medicine. On his return to New York in September, 1905, he began to practice, but his time was practically spent at the Rockefeller Institute in the forenoon and at the dispensary at the Babies Hospital in New York and at Bellevue Hospital in the afternoon. In 1910, he spent four months abroad, partly with Prof. Heinrich Finkelstein, to whom he attributed most of the inspiration he received for the study of pediatrics, and partly at the Kaiserin Auguste Victoria Haus, where he did chemical work under Professor Langstein and Dr. Edelstein. In 1910, he founded and became medical director of the Tuberculous Preventorium for Children in Farmingdale, N. J., and was its president for several years. In 1911, he became a member of the board of trustees and the medical director of the Home for Hebrew Infants, which positions he retained until his death. From 1908 to 1920, he was active in the laboratories of the department of health under Dr. William H. Park, and from that time until his death he was a member of the department of pathology at Columbia University, where he carried on most of his laboratory work. From 1916 to 1931, he was clinical professor of pediatrics at New York University.

Alfred Hess will be missed by many outside of his family circle, and his memory will be cherished by all who had the privilege to know him intimately as a rarely gifted, kind, wise and cultured man.

HENRY J. GERSTENBERGER.

Abstracts from Current Literature

Pathology, Bacteriology and Biochemistry

PLASMAPHERESIS EDEMA: I. THE RELATION OF REDUCTION OF SERUM PROTEINS TO EDEMA AND THE PATHOLOGICAL ANATOMY ACCOMPANYING PLASMAPHERESIS; II. THE EFFECT OF REDUCTION OF SERUM PROTEIN ON THE ELECTROLYTE PATTERN AND CALCIUM CONCENTRATION. DANIEL C. DARROW, EDWARD B. HOPPER and M. KATHARINE CARY, J. Clin. Investigation **11**:683 and 701 (July) 1932.

After plasmapheresis, dogs showed a type of edema closely analogous to that in cases of nephrosis, hydropigenous nephritis, nutritional edema and cachectic states. The dogs were bled repeatedly, once or twice a day, and after removal of the plasma the cells, mixed with salt solution, were reinjected. By this procedure the albumin and the globulin of the blood plasma were reduced in approximately the same proportions. After the bleedings were stopped, the restoration of the globulin was more rapid than that of the albumin. There seemed to be a critical concentration of from 3 to 3.5 per cent total plasma protein at which edema appeared. From microscopic studies a conclusion was drawn that low plasma protein should not be considered a cause of permanent renal damage. Electrolytic studies of the serum and of the ascitic fluids of dogs rendered edematous by plasmapheresis were reported. Equations were given which describe the following relationships: 1. The concentration of chloride in milliequivalents per liter varied inversely with that of the total protein in grams per hundred cubic centimeters. 2. The chloride varied inversely with the base-protein in milliequivalents per kilogram of water. 3. The calcium and protein concentrations varied directly with each other.

GUEST, Cincinnati.

THYROID HYPERPLASIA PRODUCED IN CHICKENS BY ULTRAVIOLET LIGHT DEFICIENCY. KENNETH B. TURNER and ETHEL M. BENEDICT, J. Clin. Investigation **11**:761 (July) 1932.

Enlargement of the thyroid glands of growing, nonrachitic chickens may be produced by the exclusion of ultraviolet rays. Histologically, the glands are hyperplastic and poor in colloid. The enlargement of the thyroid is not accompanied by an increase in the bird's consumption of oxygen. The hyperplasia may be prevented by the administration of potassium iodide.

AUTHORS' SUMMARY.

STUDIES OF SERUM ELECTROLYTES: VIII. THE CONCENTRATION OF ELECTROLYTES AND NON-ELECTROLYTES IN THE SERUM FOLLOWING INSULIN ADMINISTRATION IN DIABETIC PATIENTS. F. WILLIAM SUNDERMAN, J. HAROLD AUSTIN and PRISCILLA WILLIAMS, J. Clin. Investigation **11**:1261 (Nov.) 1932.

Concentrations of electrolytes and nonelectrolytes were determined in the blood serum of seventeen patients with severe diabetes during hyperglycemia allowed to develop by withholding insulin for eighteen or more hours and after the blood sugar was restored to normal by the administration of insulin. Following the administration of insulin, the following changes were noted: 1. The inorganic phosphorus and cholesterol diminished. 2. The concentrations of total base, sodium and chloride and the specific conductivity of the serum increased. 3. The osmolar concentration of the serum, measured by the freezing point, generally decreased, suggesting that the increased concentration of electrolytes did not compensate completely for the decreased concentration of blood sugar. 4. The specific gravity tended to increase. It was concluded that the final picture represented a change in the serum toward the normal.

GUEST, Cincinnati.

COLLOID-OSMOTIC PRESSURE OF THE BLOOD IN VARIOUS MEMBRANES. L. J. DELBAERE, Nederl. tijdschr. v. geneesk. **76**:5648 (Dec. 10) 1932.

In the estimation of the colloid-osmotic pressure of the blood, the width of the pores of the membranes used are of essential importance. In estimations made in the same serum or plasma by means of membranes of different width, the membranes with the widest pores, which are just impermeable to proteins, give higher values than both the least permeable membranes and membranes of mean permeability.

As for the balance between the fluids in and around the capillaries, only that colloid-osmotic pressure is of importance which is established by the capillary wall; consequently, for the study of the water balance of the body, membranes will be required in which the width of the pores is similar to that of the pores in the walls of the vessels.

VAN CREVELD, Amsterdam, The Netherlands.

Nutrition

OBSERVATIONS ON VITAMIN A DEFICIENCY IN DOGS. A. M. STIMSON and O. F. HEDLEY, Pub. Health Rep. **48**:445 (April 28) 1933.

The effects of feeding twelve dogs a diet markedly deficient in vitamin A are described. In ten of the dogs characteristic ophthalmia developed after widely varying periods of time. Other symptoms were inconstant, except that in all the animals there was a terminal loss of appetite, weight and strength, frequently followed by death.

A noteworthy feature was the sudden development of the ophthalmia without significant premonitory symptoms. It suggests that in A avitaminosis profound physiologic changes may occur without being detected by available means. The experiments indicate further that great individual differences exist in susceptibility to deprivation of vitamin A. While this is conveniently ascribed to variations in storage of the vitamin in the tissues, other possible factors, such as the general state of vigor and the influences of season, have not been ruled out.

LEMASTER, Evanston, Ill.

FAMILIAL RICKETS WITH OBSCURE ETIOLOGY. REGINALD LIGHTWOOD and I. W. WOOD, Proc. Roy. Soc. Med. **26**:277 (Jan.) 1933.

A boy of 8½ years had received cod liver oil and orange juice from the age of 1 month, and from the age of 9 months he was given a liberal diet of bacon, eggs, vegetables, fruit, butter and milk. He was retarded both mentally and physically. He did not walk until he was 3½ years of age, and soon after this it was noticed that he had genu valgum. A sister, aged 10 years, had been treated for genu valgum at the age of 5 years. The classic deformities caused by severe rickets were found to be present. There was no albuminuria or sign of arterial or renal disease, and the Wassermann reaction was negative. His younger brother, aged 5½ years, showed even more advanced rickets, and he also was mentally retarded. Roentgenograms of both patients showed the classic changes of advanced active rickets. A table showing the blood chemistry in each case is given in the report, and photographs of the children and of the x-ray plates are included.

WILLIAMSON, New Orleans.

INTRAVENOUS LIPOTHERAPY IN THE TREATMENT OF DYSTROPHY OF NURSLINGS. T. VALLEDOR, Arch. de méd. d. enf. **36**:276 (May) 1933.

Severe dystrophies of tuberculous origin in nurslings are extremely common in Cuba where social conditions are peculiarly favorable to the development of these menacing disorders of early life. Whenever the continuance of breast feeding is feasible, this has proved the ideal procedure, but in hospitalized patients the various types of artificial feeding have been signally unsuccessful. The experi-

mental work of Royer demonstrated the preponderant rôle of the endothelium of the alveolar capillaries in the digestion and fixation of fats, without intervention of the liver. With the object of supplying fats to the organism through extra-alimentary feeding, the author employed intrapleural injections of olive oil in an infant suffering from advanced malnutrition. After transient improvement the patient died. Autopsy showed intense pachypleuritis, with nonabsorption of the oil. Attempts to induce oleothorax with vegetable oils furnished equally poor results. Consideration was then given to the preparation of colloidal substances which could be injected intravenously without danger of embolism. Such a preparation was developed through the combination of a saline solution of colloidal cholesterol (4 cc.) and, in suspension, 1 cc. of pure olive oil. Each ampule contained 2 cg. of cholesterol. Observations were made on guinea-pigs into which 2 cc. of this emulsion had been injected intraventricularly and on rabbits that were given 5 cc.; in neither case was there any complication. In infants it was found that if the ampule was first shaken thoroughly and the injections made very slowly, there were no ill effects in more than 1,000 treatments of this character; some of the patients have been followed up for periods approaching three years, and new cases are continually being added to the roster. Valledor concludes his monograph with clinical reports of 12 cases in which the gain in weight and strength is particularly significant.

AMESSE, Denver.

RICKETS: RECENT DISCOVERIES AND THEIR INTERPRETATIONS. A. B. MARFAN, Gaz. d. hôp. **106**:115 (Jan. 25) 1933.

The author emphasizes his view that experimental rickets in animals differs from that in man in that the changes in the bone marrow in the former are slight. The fact that rickets is seen in Italy, southern France and Algeria demonstrates that deprivation of ultraviolet rays cannot be the real cause. The author believes that the infections and intoxications of late fetal and early postnatal life, if of sufficiently long standing, are the primary causes; of these, congenital syphilis is the most important.

KAJDI, Baltimore.

INJECTION OF MATERNAL BLOOD IN SEVERE VOMITING OF INFANCY. H. AUDÉOUD, Rev. franç. de pédiat. **8**:737, 1932.

The author used intramuscular injections of maternal or paternal blood with success in eight infants with severe vomiting. The ages of the children varied from 5 weeks to 3 months, and the number of injections, from one to ten. This method was successful in cases in which the patient showed peristaltic waves and other signs of a pathologic condition of the pylorus.

SANFORD, Chicago.

THE USE OF POWDERED MILK IN THE FEEDING OF INFANTS. P. CERESA, Prat. pediat. **10**:539 (Dec.) 1932.

Dr. Ceresa briefly reviews the literature on the use of dried milk in the feeding of infants. He then outlines eleven instances in which a change to dried milk formulas seemed to solve the problem of feeding infants under his observation in the pediatric clinic at Pisa.

DOOLEY, Kent, Conn.

INFLUENCE OF THE THYMUS ON THE PHOSPHORUS CONTENT OF THE BLOOD. N. MARTINETTI, Riv. di clin. pediat. **31**:163 (Feb.) 1933.

The author determined the inorganic and the organic phosphorus content of the blood serum of young rabbits before and at varying periods after the extirpation of the thymus gland.

Following thymectomy, there is a definite fall in the inorganic and organic phosphorus content of the blood, which reaches its maximum on the second day

and slowly returns to normal by the sixteenth day. Subcutaneous injection of thymus extract into rabbits causes a slight temporary increase in the phosphorus content of the blood.

HIGGINS, Boston.

EXPERIMENTAL STUDY OF THE TOXICITY OF MILK SECRETED DURING THE MENSTRUAL PERIOD. FERNANDA BORSARELLI, Riv. di clin. pediat. **31**:189 (Feb.) 1933.

Human milk secreted during the menstrual period has frequently been suspected of containing toxic products. The author has made tests of such milk for toxicity on germinating legumes, on cultures of Aspergillus niger and on tadpoles.

Milk was added to the solutions in which the legumes were germinating. Normal mother's milk resulted in diminished growth as compared to the control. Milk of the menstrual period resulted in even more diminution of the growth.

The growth of Aspergillus niger was not consistently affected when either normal breast milk or milk of the menstrual period was added to the mediums.

The survival and metamorphosis of the tadpoles were unfavorably affected when normal milk was added to the water in which they were kept. The effect was even more unfavorable when the milk of the menstrual period was added.

Although the laboratory data tend to point to some toxic constituents in the milk of the menstrual period, the author does not feel that the effect on the nursling is sufficient to warrant taking the infant from the breast, even temporarily.

HIGGINS, Boston.

THE MODIFICATION OF PROTEIN IN THE BLOOD SERUM OF EDEMATOUS INFANTS. A. SALLERES P., Arch. d. hosp. de niños **2**:57 (June) 1932.

The author concludes that in the edematous subject hypoproteinuria exists in the initial period of the formation of the edema. This hypoproteinuria is at the expense of a diminution of the serum albumin. The globulin fraction remains normal. This leads to an alteration of the protein quotient. The diminution of the serum albumin is independent of albuminuria in the period of resolution of the edema. During the period of reparation or cure, there is a normal state of proteinuria brought about especially at the expense of augmentation of the serum globulin and with augmentation, to a lesser degree, of serum albumin. The globulin fraction in this period is generally increased over the level of the serum albumin. The protein quotient sinks below normal. In the period of definite recovery, the various factors approach normal levels. This is brought about by an increase of serum albumin and a diminution of serum globulin. The diminution of serum albumin produces a diminution in the oncotic pressure of the proteins. The primary effect of the organism to establish a normal metabolism is expressed in an increase of the globulin fraction.

SCHLUTZ, Chicago.

PARATHYROID AND VITAMIN D: THE INFLUENCE ON BONES AND GROWTH. ALBERT RANSON, Semana méd. **1**:1424 (May 5) 1932.

Simultaneous treatment with parathyroid and vitamin D causes a more rapid development of the body and better growth of bone without any danger of hypercalcification of other organs.

KUGELMASS, New York.

COMPARATIVE STUDIES ON THE MORPHOLOGIC RELATION OF THE BROWN AND WHITE FAT DEPOSITS IN INFANCY. FELIX WEISS, Arch. f. Kinderh. **99**:28 (March 21) 1933.

Both the brown and the white fat deposits in premature infants are characterized by mulberry cells, which are cells containing many small droplets of fat. In full-term new-born infants and in older infants the fat consists more often

of cells containing one large droplet of fat. However, when any pathologic loss of fat occurs, the fat deposits, both brown and white, tend to revert to the primitive type of fat tissue, in which mulberry cells are frequent.

LEMASTER, Evanston, Ill.

CHEMICAL AND PHYSICAL PROPERTIES OF BONE IN EXPERIMENTAL SCURVY. G. BAYER, Beitr. z. path. Anat. u. z. allg. Path. **87**:204, 1931.

Chemical analysis of scorbutic bones showed an undisturbed percentage composition and total mineral content as compared with normal bones. Nevertheless, the diaphyses of the long bones showed increased fragility. The latter was probably due to osteoporosis.

BOIKAN, Chicago. [ARCH. PATH.]

STUDIES IN RICKETS: II. METABOLISM IN BEGINNING RICKETS; DIVISION OF RICKETS INTO STAGES ACCORDING TO THE PHASE OF DISTURBANCE OF MINERAL RETENTION. E. ROMINGER, H. MEYER and C. BOMSKOV, Ztschr. f. d. ges. exper. Med. **78**:259 (April) 1931.

The phosphorus pentoxide balance and the calcium oxide balance were studied for a considerable period in eight cases of rickets. Four cases of spontaneous rickets were followed from the beginning; with the first onset of characteristic roentgenographic findings they showed a negative phosphorus pentoxide balance characteristic of the authors' first stage. This was followed by the second stage, in which both phosphorus pentoxide and calcium oxide showed a negative balance. The period of beginning healing, or third stage, showed a positive phosphorus pentoxide balance. In cases of recurring rickets in which treatment had been instituted and then stopped, the drop in the phosphorus pentoxide balance was more rapid and more marked, although the calcium oxide balance, as characteristic of the first stage, remained normal. Two cases of florid rickets showed the characteristics of the second stage, i. e., a negative balance for both phosphorus pentoxide and calcium oxide.

LESLIE, Chicago.

STUDIES IN RICKETS: III. THE DISTURBANCE IN PHOSPHORUS METABOLISM IN EXPERIMENTAL THALLIUM RICKETS. E. ROMINGER, HUGO MEYER and C. BOMSKOV, Ztschr. f. d. ges. exper. Med. **78**:272 (April) 1931.

The intake and output of phosphorus pentoxide and of calcium oxide were determined in thirty-six young rats used as controls and in twenty young rats to which 0.4 cc. of a 1:1,000 solution of thallium acetate was given daily. The determinations were made for successive three day periods, and the total duration of the experiments was from four to six weeks. It was found that with the beginning of the administration of thallium there occurred a decrease in the retention of phosphorus pentoxide while the retention of calcium oxide remained undisturbed. When more thallium was given, there was a gradual decrease in the retention of calcium and the disturbance in the retention of phosphorus became much greater. Only when the stage of decalcification of the bones was reached did the calcium balance fall markedly. This progression corresponds to the first and second stages of rickets as described previously and may be considered as characteristic of rickets produced by noxious agents as well as of that due to lack of vitamin D.

LESLIE, Chicago.

VISCOSIMETRIC STUDIES OF THE WATER-BINDING CAPACITY OF PLASMA COLLOIDS: IV. THE WATER-BINDING CAPACITY OF PLASMA COLLOIDS IN ALIMENTARY AND INFECTIOUS FEVERS OF INFANTS: V. THE WATER-BINDING CAPACITY OF PLASMA COLLOIDS IN ALIMENTARY DYSTROPHIES OF INFANTS. JOHANNES JOCHIMS, Ztschr. f. Kinderh. **53**:42 and 59, 1932.

In infectious fevers there was a definite increase in the water-binding capacity of the plasma as determined by the viscosimeter. In experimentally produced dehydration fever there was no such increase, but a slight measurable decrease.

The changes in the plasma colloids in dehydration fever were also indicated by a fall in the speed of sedimentation of the erythrocytes.

In alimentary dystrophies, the water-binding capacity was found to be diminished, the average being below the lowest normal value. Compared to the normal infant, the dystrophic infant has less bound water in the plasma.

ABSTRACTOR'S NOTE.—It is questionable whether the water-binding capacity or free water can be determined by the viscosimeter. SHELLING, Baltimore.

ERGOSTEROL AND CALCIFICATION OF THE HUMAN AORTA. RUDOLF SCHOENHEIMER, Ztschr. f. physiol. Chem. **211**:65, 1932.

Ergosterol could not be demonstrated in the ash of arteriosclerotic aortas by spectrophotometric methods or in biologic experiments on vitamin D. Also the cholesterol freed from the unsaponifiable substances, which was thereby fifty times concentrated, did not show, even with large doses, any antirachitic effect.

HUEPER, Philadelphia. [ARCH. PATH.]

INFLUENCE OF THE THYROID GLAND ON THE GROWTH OF BONE IN B-AVITAMINOSIS. T. OGAWA and Y. OHNISHI, Folia endocrinol. japon. **7**:35, 1931.

Of rats fed a vitamin B-free diet, the thyroidectomized ones showed greater disorders of growth, especially of the bones, than did the others. The administration of a little thyroid acted less favorably on the growth and on the formation of bone of the thyroid-free animals than on those of the controls.

KUGELMASS, New York.

ANTISCORBUTIC VALUE OF THE JUICE OF BANANAS RIPENED IN SWEDEN. K. WEJDLING, Acta pædiat. **13**:473 (June 6) 1932.

Bananas brought to Sweden while still green were allowed to ripen until the skins were yellow with a few black spots. They were peeled quickly to prevent undue oxidation and mashed in vacuo, and the juice was pressed out in an atmosphere of carbon dioxide and stored in the icebox for a maximum period of four days. No antiscorbutic value (protection tests on guinea-pigs) could be demonstrated when this juice was used in amounts of from 4 to 20 cc. daily, corresponding to from 5 to 25 Gm. of whole banana. MCINTOSH, New York.

ALIMENTARY HYPOGLYCEMIA IN CHILDHOOD. E. LÖVEGREN, Acta pædiat. **13**:520 (June 6) 1932.

A girl 6 years of age showed hunger and a craving of sweets shortly after every meal, even when she had eaten heartily. If not fed again, she became fretful and easily fatigued and exhibited a striking dusky pallor. The blood sugar level at intervals of half an hour after a normal breakfast of oatmeal, zwieback and milk was 91, 67, 80, 76 and 66 mg. per hundred cubic centimeters. (The level during fasting was not determined.) The curve constructed from these values resembles that for a normal adult following the injection of insulin. After interpreting the child's behavior as an evidence of alimentary hyperinsulinism, Lövegren prescribed sugar after meals, with complete and dramatic cure of all the diurnal symptoms. Restlessness during sleep, with grinding of the teeth and sudden crying out, persisted until resort was made to the oral administration of about 10 Gm. of dextrose at bedtime. MCINTOSH, New York.

Prenatal Conditions

ALBINISM IN THE PROGENY OF NEGRO AND WHITE PARENTS. C. M. SWAB, Am. J. Ophth. **15**:306 (April) 1932.

The author reports a case of albinism in a boy, aged 8 years, a middle grade idiot, who was 45 inches (114.3 cm.) tall and weighed 44 pounds (20 Kg.). His father, who was white, married a Negress, and their first child, a girl, was black.

Through incest between the father and his half-breed daughter, when she was 15 years old, this idiot albino resulted. The facies, shape of the head and kinky hair were typically negroid, except for the lack of pigment. Examination of the eyes revealed an alternating, divergent squint of approximately 15 degrees. The irides were light gray-blue. There were sheetlike opacities in the vitreous, and the disks were almost dead white. The choroidal vessels were visible through the eyegrounds. There was about 8 diopters of myopia in each eye. The author discusses the frequency of albinism, its etiology and the reason for the poor vision of these persons. He suggests the use of a contact glass opaque except for a pupillary opening 2 mm. in diameter.

REESE, Philadelphia. [ARCH. OPHTH.]

HEREDITARY DEFORMING CHONDRODYSPLASIA. M. A. SPANGELBERGER, Ann. Int. Med. **5**:962 (Feb.) 1932.

A case of chondrodysplasia is reported in a boy of German descent, aged 11, the eldest of three children. His development was normal until he was 3½ years of age, when knoblike excrescences were noticed in close relation to the joints of the extremities. They appeared simultaneously and were most prominent about the knee joints. Walking became difficult, and normal movements of the wrists and elbows were limited. Cod liver oil and dietetic measures were employed without avail, and braces were unsatisfactory. The patient moved about with difficulty, being obliged to crawl at times. Improvement was noted at 5 years of age, when he began to walk. He entered school at 6 years and had since been active. There had never been a fracture. The father was 37 years of age and healthy; the mother, 35, and tuberculous; she had exophthalmic goiter. There was no family history of short stature or limitation of movements of the joints. When the patient was seen, at 11 years of age, his joints were misshapen, and there were knoblike protuberances at the elbows, wrists, knees and ankles and about the chest and pelvis. There was a varying amount of limitation of movement in all the major joints. The gait was awkward, but the patient was remarkably agile despite the distorted joints. The tonsils were hypertrophic and contained caseous material. The heart showed a brief presystolic murmur at the apex but was otherwise normal. There were various abnormalities of the skeletal system, as shown by roentgenograms and by physical examination. There were many enchondromas and spurs. Shortening of the extremities, the short stature, inability to extend the forearms fully and the multiple exostoses near the ends of the long bones were characteristic symptoms. The diagnosis is discussed in detail. There was no evidence of a hereditary origin. There was a history of exophthalmic goiter and tuberculosis in the mother.

WILSON, Norfolk, Va.

CONGENITAL HEART WITH MASSIVE ENLARGEMENT. CHARLES GILMORE KERLEY, Arch. Pediat. **50**:217 (March) 1933.

The author reports a case of congenital heart disease with massive enlargement.

WADDELL, JR., University, Va.

CONGENITAL ESOPHAGOTRACHEAL FISTULA. F. A. TRUMP, J. Pediat. **2**:212 (Feb.) 1933.

In the case reported, the upper end of the esophagus ended as a blind sac and the lower end connected with the trachea. Life was maintained for thirty-seven days by the use of dextrose solution injected intraperitoneally.

LEMASTER, Evanston, Ill.

PATENT DUCTUS ARTERIOSUS. D. C. MUIR and J. W. BROWN, Arch. Dis. Childhood **7**:291 (Dec.) 1932.

In a study of eighty-eight school children with congenital heart disease, twenty were found to have signs which suggested a patent ductus arteriosus as the sole abnormality. Criteria necessary to establish a diagnosis are: (1) the presence of a

continuous or machinery bruit in the second left space; (2) the presence of a long, rough systolic bruit with maximum intensity in the second left interspace, with conservation, accentuation or reduplication of the pulmonary second sound; (3) Gerhardt's ribbon dulness; (4) roentgen evidence of dilatation of the trunk of the pulmonary artery, and (5) comparative absence of symptoms. A combination of any three of these symptoms is considered adequate for diagnosis.

KELLY, Milwaukee.

CONGENITAL EPULIS. D. STEWART MIDDLETON and W. F. HARVEY, Edinburgh M. J. **40**:257 (May) 1933.

Congenital tumors of the gum are rare. This case brings the number in the literature to fourteen. At 5 weeks of age the patient was seen because of a tumor of the gum and difficulty in nursing. The tumor is described as a small pinkish growth, ovoid laterally and the size of a cherry; it was visible between the lips, the upper lip being everted by it. The growth was firm in consistency. The covering was normal mucous membrane attached by a pedicle to the gum margin of the upper jaw just to one side of the midline, in the location of the future left central incisor.

The cases reported show that a tumor of this type always occurs in the incisor region of the gum and always in a female child. It does not interfere with the eruption of the tooth.

The authors' report includes the results of the pathologic examination, which showed a polypoid growth. The microscopic sections shown are clear and excellent; the tumor cells display no organoid pattern and seem to be of mesodermic origin. The growth is regarded as a maldevelopment of the musculature with degenerative but not xanthomatous changes. It was probably not a true neoplasm.

NEFF, Kansas City, Mo.

PROPHYLAXIS AND THERAPY OF PREMATURITY. STORK, Arch. f. Kinderh. **99**:109 (April 28) 1933.

The cause of premature delivery in 2 per cent of the cases was trauma; in 5 per cent, syphilis; in 9 per cent, placenta praevia, and in 10 per cent, eclampsia and nephritis. In the remaining cases of prematurity, no satisfactory explanation could be found. The mortality in premature infants born spontaneously was 33 per cent; in those delivered by the aid of instruments, 52 per cent. Cerebral hemorrhage was observed more frequently in the premature infants than in the full-term infants, and bronchopneumonia was found in 68 per cent of the former who came to autopsy. Infections of the respiratory tract were avoided by strict aseptic technic in nursing care and by rigid exclusion of all attendants showing catarrhal symptoms. The mortality of premature infants born at home and then brought to the hospital was considerably higher than that of infants born in the hospital; this higher mortality was presumably due to chilling. Measures should always be taken to maintain the body temperature of the infants during transportation. Human milk was fed to all premature babies until they were old enough to take other preparations safely. In some instances of failure to gain, repeated small injections of a parent's whole blood intramuscularly gave excellent results. Ovarian hormone preparations and pituitary extracts were administered to a few infants but were discontinued because severe reactions occasionally followed.

LEMASTER, Evanston, Ill.

HEREDITARY DEGENERATIVE DISEASE OF THE INNER EAR FROM THE POINT OF VIEW OF HEREDITARY PATHOLOGIC CONDITIONS. V. HAMMERSCHLAG, Monatschr. f. Ohrenh. **66**:1281 (Nov.); 1503 (Dec.) 1932.

The starting point of Hammerschlag's study of the transmission of hereditary degenerative disease of the inner ear is that hereditary degenerative deafness, progressive labyrinthine baryecoia and otosclerosis are manifestations of a single

genetically uniform disease. The transmission of this hereditary degenerative disease of the inner ear is best explained by the assumption of a monomeric multiple allelomorphic hereditary transmission. It is in agreement with the certain monomeric transmission of the hereditary deafness of the waltzing mouse; it explains the fluctuating intensity of the disease; it makes the phenomenon of twofold transmission (dominant and recessive) comprehensible, and, finally, it also explains the appearance of phenotypically healthy persons among the offspring of deaf parents. It therefore does not conflict with any fact known at present.

EDITOR'S ABSTRACT. [ARCH. OTOLARYNG.]

PERIPHERAL CIRCULATION OF THE PREMATURE INFANT. A. ECKSTEIN, Ztschr. f. Kinderh. **54**:317 (March) 1933.

The peripheral circulation of premature infants was studied by injecting material with contrast mediums (iodine) post mortem and then resorting to roentgen and histologic examinations, and also by examining the capillaries of the nail-beds by means of a microscope. By the latter method, the functional response of the capillaries to changes in temperature was also studied. It was found that the capillaries of premature infants are functionally insufficient, and thus there is a tendency to bleeding and to collapse of the peripheral circulation.

SHELLING, Baltimore.

RESEARCHES ON SCLEREDEMA IN PREMATURE INFANTS. A. ECKSTEIN and H. M. SCHUMACKER, Ztschr. f. Kinderh. **54**:338 (March) 1933.

In scleredema of premature infants the authors found an increase of body fluids in the subcutaneous tissues. The cause of the edema is explained on the basis of underdevelopment of the subcutaneous tissue and the inability of resorption of the accumulated fluid to take place.

SHELLING, Baltimore.

AN INVESTIGATION ON THE AMYLASE CONTENT OF THE SALIVA OF THE PREMATURE INFANT. G. HENSEL, Ztschr. f. Kinderh. **54**:367 (March) 1933.

The amylase content of the saliva was determined in eight premature infants, in four full-term infants and in a number of children and adults. Four hundred and seventy determinations were made in all. The ferment content of the saliva of premature infants is not lower than that of full-term infants. Both, however, are two and one-half times lower than that of older children and five times lower than that of adults. In the premature infant the amylase does not change after the feeding of starchy foods.

SHELLING, Baltimore.

NEWLY DISCOVERED SYMPTOM FOR THE DIAGNOSIS OF ANENCEPHALUS. Y. KATSU, Jap. J. Obst. & Gynec. **15**:507 (Dec.) 1932.

The reports of Viana and Pinzani are substantiated. If pressure is exerted on the head when anencephalia exists in the fetus, there is a marked decrease in the fetal heart rate. The slowing is more marked and more rapid in onset than that occurring during uterine contractions; further, this phenomenon may be elicited between contractions. This phenomenon is known as Negri's sign.

The author reports two cases of anencephalia diagnosed by this method. The first case was in a primipara aged 21, in whom there was marked slowing of the fetal heart rate when pressure was applied to the head by the examining fingers during vaginal examination. The second case occurred in a 31 year old multipara with marked polyhydramnios. The same sign was demonstrated in this instance, the rate decreasing to 87 per minute during pressure on the head, which was presenting. A further phenomenon noted during pressure was a marked increase in fetal movements; at times they became spasmodic.

ADAIR and ARNOLD, Chicago.

DIAGNOSIS OF ANENCEPHALIA. G. AHLTORP, Acta obst. et gynec. Scandinav. **13**:93, 1933.

Anencephalia may be suspected when manipulations of the fetal head produce excessive fetal movements; this observation was first made by Laulargne in 1883, with almost simultaneous discovery of the phenomenon by Pinard. It was later noted that there were spontaneous violent, irregular movements of anencephalic fetuses, probably caused by pressure of the brain substance against the uterine wall. Falls observed highly irregular heart tones during delivery of an anencephalus.

The diagnosis of anencephalia took a definite forward step in 1917, when Case definitely demonstrated the presence of an anencephalus in utero by roentgenography. The characteristic picture is absence of the skull cap; the base of the skull and the facial skeleton are very irregular, the orbital cavities are small, and the sella turcica is usually absent. Since 1917, more than forty cases diagnosed by roentgenography have been reported.

Roentgenography is indicated when the fetal head cannot be definitely palpated, in cases of polyhydramnios, and when there are vigorous fetal movements during palpation of the head.

ARNOLD, Chicago.

Diseases of the New-Born

THE NEWBORN. BARNET E. BONAR, J. Pediat. **2**:619 (May) 1933.

In this critical review the recent contributions concerning the new-born infant are mentioned and discussed. The greatest opportunity for reduction in the mortality rate lies in improved neonatal and prenatal care. Among the subjects discussed are: nutrition of the fetus and the new-born infant, vomiting from functional and organic causes and other alimentary disorders, such as infections, malpositions and hernias.

LEMASTER, Evanston, Ill.

ICTERUS NEONATORUM. MURRAY B. GORDON and MICHAEL C. KEMELHOR, J. Pediat. **2**:685 (June) 1933.

The erythrocyte count, hemoglobin, icteric index and presence of clinical jaundice were determined on thirty full-term, healthy, new-born infants on alternate days from the second to the tenth day of life. Tests of the fragility of the erythrocytes were made on the second and tenth days. The hemoglobin and erythrocyte count were high at first, gradually dropped during the first six days and then slowly increased. The fragility of the red cells was increased on the second day but approached normal by the tenth day. Clinical jaundice was present in twenty-five of the thirty infants and was most marked during the first six days. The icteric index rose during the first six days and then decreased parallelly with the degree of clinical jaundice. The authors interpret these findings as indicating the hemolytic origin of icterus neonatorum.

LEMASTER, Evanston, Ill.

ERYTHROBLASTOSIS IN ICTERUS GRAVIS NEONATORUM. ARTHUR F. ABT, J. Pediat. **3**:7 (July) 1933.

Various clinical and pathologic similarities between icterus gravis neonatorum, hydrops congenitus universalis and anemia of the new-born are discussed. Two cases of icterus gravis neonatorum are reported with complete gross and microscopic pathologic findings. The author suggests that the fetal type of liver found in icterus gravis has failed to mature properly, possibly due to a defect in the germ plasm in familial cases or to toxic injury early in pregnancy in sporadic cases. Embryonic hematopoietic persistence is proposed as a more accurately descriptive name than erythroblastosis in designating the underlying disturbance. The symptoms and signs generally found in cases of icterus gravis are reviewed and analyzed from the theoretical point of view.

LEMASTER, Evanston, Ill.

FETAL AND NEONATAL MORTALITY. CLIFFORD G. GRULEE, J. Pediat. **3**:132 (July) 1933.

The causes of death in cases of stillbirth and in new-born infants were studied and analyzed to determine in which cases the mortality may be reduced. Under present conditions, the chief hope lies in lowering the number of deaths due to congenital syphilis, infections and trauma at birth. The large group of cases of malformation, congenital debility and allied conditions offers little chance of any immediate substantial decrease in mortality. However, it is possible that in the future, when more adequate knowledge is available concerning the causes of serious disturbances of the fetus and the new-born infant, much improvement in fetal and neonatal mortality may be expected. LEMASTER, Evanston, Ill.

ESOPHAGEAL ULCER IN THE NEWLY BORN. MARTIN M. BROWN and ELLIS KELLERT, New England J. Med. **209**:202 (July 27) 1933.

The fundamental process in esophageal ulcer appears to be an injury, infection or both. Mucosal ulcers of the esophagus have been attributed to tears following extreme torsion and to flexion of the fetus, associated with engorgement of the vessels. Cohnheim observed years ago that necrosis and hemorrhage followed the deposit of bacteria in the wall of a vessel, and this may be the underlying change in esophageal ulcer.

Two cases which came to autopsy are reported. GENGENBACH, Denver.

OSSEOUS DYSTROPHY FOLLOWING ICTERUS GRAVIS NEONATORUM. FRANCES BRAID, Arch. Dis. Childhood **7**:313 (Dec.) 1932.

A case of osseous dystrophy following icterus gravis neonatorum is reported. Similar changes in the bones developed in experimentally jaundiced puppies. The liver apparently plays some part in calcium metabolism and therefore in the normal growth of bone and of nerve tissue. It is suggested that the liver not only stores vitamins but controls their distribution and activities in normal conditions. This function may be impaired in prolonged jaundice, and when this occurs in infancy, a pathologic condition of the bones and nerve tissue may result.

KELLY, Milwaukee.

OBSTETRIC HEMIPARALYSIS OF THE DIAPHRAGM. ALFIO PUGLISI, Arch. argent. de pediat. **3**:683 (Nov.) 1932.

Obstetric hemiparalysis of the diaphragm, an extremely unusual form of paralysis, was observed in a new-born infant following a prolonged labor and delivery by forceps. There were considerable injury to the region of the neck and a fractured clavicle on the right side. The brachial plexus, including the phrenic nerve, was severely traumatized. The right side of the diaphragm showed complete paralysis with marked elevation of the liver. The infant showed cyanosis almost continually and became very dyspneic, especially during any attempt at nursing. There was a distinct lag in respiratory movement on the right side. The patient made a complete recovery. SCHLUTZ, Chicago.

CARDIOSPASM IN THE NEW-BORN. JUAN P. GARRAHAN and ESTEBAN MUZIO, Arch. argent. de pediat. **3**:715 (Nov.) 1932.

The authors report a case of the comparatively rare condition, cardiospasm in the new-born. Intense vomiting began the day after birth and occurred immediately after the ingestion of food. Continued feeding by tube caused cessation of the vomiting and eventually led to complete recovery. SCHLUTZ, Chicago.

IDENTIFICATION OF NEW-BORN IN HOSPITAL. J. A. BERUTI and S. SALA, Arch. med. d. hosp. Ramos Mejia **15**:107 (Sept.) 1932.

The various methods of identification of the new-born are discussed, and photographs are presented. A satisfactory method must combine simplicity and adaptability with the means of immediate identification of the mother and child. The author favors the method of making a numerical impression on the skin by means of ultraviolet irradiation.

SANFORD, Chicago.

PULMONARY EDEMA IN A NEW-BORN INFANT. C. PERNETTA, Rev. brasil. de pediat. **1**:17 (Jan.-Feb.) 1933.

The author's patient was 13 days old and recovered following a temperature of 38.5 C. (101.3 F.) and a pulse rate of 160. The etiologic agent is probably an infectious grippal organism. The symptoms are cyanosis, apnea and dyspnea; there may be gastro-intestinal symptoms and anorexia. Fine subcrepitant râles may be heard in the lungs. The treatment is symptomatic, consisting of oxygen, lobeline and cardiac stimulants.

SANFORD, Chicago.

CONJUNCTIVITIS IN THE NEW-BORN. IDA THIERRY, Rev. chilena de pediat. **4**:41 (Feb.) 1933.

The author discusses gonorrheal ophthalmia in particular and recommends that all pregnant women be carefully examined and that those affected with vulvovaginitis be properly instructed and treated. All newly born infants, regardless of whether infection is established in the mother, must have a 1 per cent solution of silver nitrate instilled in both eyes. Legal investigation is recommended, as well as attention both before and after birth to the mother affected with gonorrheal vulvovaginitis. The author also recommends the rigorous prosecution of any person who fails in respect to this type of supervision. Every patient with gonorrheal ophthalmia should be given immediate treatment by a competent specialist.

SCHLUTZ, Chicago.

OBSTETRICAL RESEARCH OF GIGANTIC CHILDREN. J. NAKAGAWA, Jap. J. Obst. & Gynec. **15**:493 (Dec.) 1932.

A study of 14,027 deliveries was made over a period of ten years. Gigantic children were divided into two classes: Those weighing between 4 and 4.5 Kg. were designated as first-degree infants, and those weighing more than 4.5 Kg. were classified as second-degree gigantic offspring. There were 153, or 1.09 per cent, first-degree infants found, and only 10, or 0.07 per cent, second-degree infants.

It was found that gigantism increased with the age of the mother; the condition was more frequent in multiparas than in primiparas. A hereditary factor was established, the paternal element being more important than the maternal; there was a preponderance of males in this group.

There was spontaneous delivery in 73 per cent of the cases and instrumental assistance in 27 per cent. There was a maternal mortality rate of 1.3 per cent. The maternal complications were atonic uterine hemorrhage, perineal and vaginal lacerations and uterine inertia. The placentas weighed on an average between 700 and 800 Gm.

ADAIR and ARNOLD, Chicago.

BILATERAL THROMBOSIS OF THE RENAL VEIN IN A NEW-BORN INFANT. U. NORDWALL, Acta pædiat. **14**:186 (Nov. 30) 1932.

A girl, aged 2 weeks, previously well, suddenly went into collapse, with vomiting, diarrhea, anuria and subnormal temperature. The following day she showed cyanosis and hyperpnea. From time to time small amounts of blood were voided. She died two days after the onset.

Autopsy showed infarction of both kidneys, which were greatly enlarged. The renal veins contained thrombi of about the same age as the renal infarctions. The bladder contained a small amount of blood, and there were hemorrhages in the suprarenal glands, the lungs, the stomach and the middle cranial fossa. There were no subcutaneous hemorrhages. An overwhelming infection was regarded as the underlying cause.

McINTOSH, New York.

Acute Infections

RHEUMATIC HEART DISEASE: II. INCIDENCE AND DISTRIBUTION OF THE AGE OF DEATH. DAVID DAVIS and SOMA WEISS, Am. Heart J. **8**:182 (Dec.) 1932.

The authors review from autopsy material the distribution of the age of death in rheumatic disease of the heart. In the first decade few patients die. In the second decade a marked increase was shown, while in the fourth decade the maximum was reached. (Percentages are not given.) It is rather surprising to find that from the fifth through the seventh decade there still occur a considerable number of deaths due to rheumatic disease of the heart. The incidence of cases of a complicating subacute bacterial endocarditis followed much the same curve as that of the uncomplicated cases. In another group with an associated acute malignant endocarditis all deaths occurred before the age of 40.

The strikingly high percentage of deaths in the second decade is explained on the basis of a high incidence of rheumatic infection in the first and second decades, with a further contributing factor in that those infected in the first decade are exposed to intercurrent infection or die of rheumatic disease of the heart in the subsequent decade.

BACHMANN, Chicago.

CONVALESCENT SERUM IN THE TREATMENT OF ACUTE COMMUNICABLE DISEASE. E. E. MARTMER, J. Michigan M. Soc. **31**:383 (June) 1932.

Martmer describes public health measures used in Detroit for the procuring and distributing of convalescent serums for scarlet fever, measles, chickenpox, whooping cough, mumps and poliomyelitis. In scarlet fever 95 per cent of contacts are said to be protected if the serum is given within two days after the exposure. The dose is not stated, though a therapeutic dose of from 30 to 60 cc. is recommended in toxic scarlet fever. As to measles, the conventional uses of serum are those recommended by the author. In whooping cough, the administration of 7.5 cc. of convalescent serum will protect the average child if it is given within five days after exposure. The author's recommendations in poliomyelitis include the use of serum intraspinally shortly after the paralysis has appeared. For the institutional control of chickenpox and mumps, the serum is advised. It is also felt that in erysipelas, epidemic encephalitis and pneumonia in infants, convalescent serum may be useful. The serum obtained from patients convalescing from scarlet fever is used in erysipelas.

SMITH, Ann Arbor, Mich.

PERCUTANEOUS METHOD OF IMMUNIZATION AGAINST DIPHTHERIA. E. E. MARTMER, J. Michigan M. Soc. **31**:801 (Dec.) 1932.

After a review of the evolution of methods of immunization against diphtheria, Martmer describes his results with the use of Löwenstein's ointment in a home for convalescent children. Fifty-eight children having positive reactions to the Schick test received five applications of the ointment by inunction at intervals of two days. One month after the course, 27.6 per cent of the children had a negative reaction to the Schick test; after six months, this number was raised to 70 per cent. Of another group of fifty-seven children receiving five applications at five day intervals, 82.4 per cent gave negative reactions to the Schick test after six months. The author feels that the method is justified by these results and because of the avoidance of protein sensitization, constitutional reactions and the danger of free toxin entering the system.

SMITH, Ann Arbor, Mich.

DIPHTHERIA IMMUNIZATION IN MAINE. WILLIAM L. HOLT, Maine M. J. **23**:109 (May) 1932.

The following practical points relating to immunization against diphtheria are emphasized: The best day for reading Schick tests is the third or fourth, for at this time false positive reactions will have faded, and delayed positive reactions will not be missed. Toxoid is superior to toxin-antitoxin because toxoid immunizes about 95 per cent of susceptible persons whereas toxin-antitoxin immunizes only from 70 to 85 per cent. Toxoid affords protection in from six weeks to two months after the second dose, as compared with from three to six months for toxin-antitoxin. Toxoid is less likely to make young children sick. Finally, it cannot produce sensitization to the horse serum present in any antitoxin that may later be given for scarlet fever or tetanus. Only two injections of toxoid are given; the second, three or four weeks after the first. The results of immunization against diphtheria conducted in various communities indicate that not less than two thirds (better, three fourths) of preschool children, and over 50 per cent of school children, must be immunized in order to give safe protection to a community.

GRAVES, New York.

MODIFICATION OF THE VACCINE RESPONSE IN RABBITS BY THE APPLICATION OF DIPHTHERIA TOXIN TO THE VACCINATION SITE. CHARLES ARMSTRONG, Pub. Health Rep. **48**:1 (Jan. 6) 1933.

Diphtheria toxin when added to vaccine virus exerted a deterrent local effect on the vaccination reaction in rabbits and produced a less severe systemic response. This effect did not occur in rabbits previously immunized with diphtheria toxin, nor did it occur when diphtheria antitoxin was added to the virus-toxin mixture. The author believes that the deterrent effect is caused by the local cellular reaction rather than by any direct influence of the diphtheria toxin on the virus.

LEMASTER, Evanston, Ill.

ENCEPHALITIS FOLLOWING VACCINATION IN AUSTRIA. M. KAISER, Arch. f. Kinderh. **93**:1 (March 13) 1931.

This article consists of a statistical study of eighty cases of postvaccinal encephalitis occurring in Austria since 1925. The average period of incubation was ten and eight-tenths days. Most of the patients affected were from 6 to 8 years old, the average age being 7 years. No case was reported in children under 2 years of age. Revaccination caused encephalitis in five boys and two girls. The mortality and frequency of the disease varied greatly from year to year.

LEMASTER, Evanston, Ill.

THE EFFECT OF PARATHORMONE ON THE EOSINOPHILS OF CHILDREN WITH DIPHTHERIA. GEORGE LENART and EMIL V. LEDERER, Arch. f. Kinderh. **93**:55 (March 13) 1931.

In normal children the injection of 1 unit of parathormone per kilogram of body weight caused a noticeable decrease in the eosinophil count after five hours, followed by a gradual rise to the normal value in twenty-four hours. In children with diphtheria, from seven to ten days after the onset parathormone caused an increase in eosinophils after five hours with a gradual decline to normal within twenty-four hours. This reaction in diphtheria is attributed to the effect of the diphtheria toxin on the parenchymal cells of the parathyroids.

LEMASTER, Evanston, Ill.

THE BLANCHING TEST IN RECURRENCES OF SCARLET FEVER. WERNER LOOK, Arch. f. Kinderh. **93**:65 (March 13) 1931.

In fourteen cases of recurrence of scarlet fever, there was definite blanching with the Schultz-Charlton test in thirteen patients. The second attacks of scarlet fever occurred from seventeen to forty-seven days after the first.

LEMASTER, Evanston, Ill.

VACCINATION WITH ATTENUATED LYMPH IN THE NEW-BORN. LEO LEMEZ, Arch. f. Kinderh. **93**:124 (April 10) 1931.

Vaccination with attenuated lymph was performed on sixteen new-born infants from 4 hours to 3 days old. The reaction proceeded to the formation of vesicles in from five to six days and to the formation of pustules in from seven to eight days. In six of the infants, the author observed a paravaccination reaction, characterized by the slow formation of a reddened papule which attained a diameter of from 4 to 6 mm. during the second week and disappeared during the third week, leaving no scar. Considerable variation occurred in blood counts taken during the first and second weeks after vaccination. In general the course of the reaction to vaccination was mild.

LEMASTER, Evanston, Ill.

THE SIGNIFICANCE OF THE ELECTROCARDIOGRAPH IN THE EARLY DIAGNOSIS OF DIPHTHERITIC MYOCARDITIS. PAUL VON KISS, Arch. f. Kinderh. **93**:198 (May 15) 1931.

Physical examination of patients with diphtheria often yields insufficient evidence for the accurate estimation of the degree of cardiac damage and of the amount of reserve strength of the heart. In these cases the electrocardiogram offers very reliable information. At times, the physical findings indicate severe myocarditis, which the electrocardiogram fails to substantiate. At other times, clinical signs of cardiac weakness are very slight but the electrocardiogram and the further course of the disease demonstrate a high grade toxic degeneration of the heart muscle. Several electrocardiographic tracings are presented to show the alterations indicating heart damage, such as flattening and widening of the T wave, splitting and notching of the Q R S complex and passive preponderance of one of the ventricles.

LEMASTER, Evanston, Ill.

THE COURSE OF INOCULATION MALARIA IN CHILDHOOD. JOSEPH SIEGL and KARL RUPILINS, Arch. f. Kinderh. **93**:272 (June 16) 1931.

Twenty-four children were inoculated with malarial parasites because of resistant syphilis or chronic lesions of the central nervous system. From 2 to 5 cc. of blood taken from a patient at the time of a chill was injected subcutaneously, intramuscularly or intravenously. The incubation period varied from seven to twenty-four days. The clinical course of the malaria was similar to that in adults. In eighteen patients spontaneous cure of the malaria occurred without treatment. Response to the administration of quinine was rapid. Passage of the malarial parasites from one person to another did not shorten the period of incubation. The authors believe that malarial inoculation is of value if it is employed in suitable cases and properly controlled.

LEMASTER, Evanston, Ill.

THE DURATION OF IMMUNITY FOLLOWING LÖWENSTEIN'S METHOD OF DIPHTHERIA IMMUNIZATION. KURT HASSMANN, Arch. f. Kinderh. **93**:292 (June 16) 1931.

Twenty-three children were immunized against diphtheria by Löwenstein's percutaneous method. At the end of four months, twenty of the children gave negative reactions to the Schick test. However, in the next few months three of the children contracted diphtheria, and thirteen months after the immunization only five of the original twenty-three children gave negative reactions. Apparently Löwenstein's method of inoculation produces an immunity which is soon lost in a high percentage of cases.

LEMASTER, Evanston, Ill.

SMALLPOX VACCINATION WITH CONSIDERATION OF THE PATIENTS FAILING TO REACT. IRENE GREINER, Arch. f. Kinderh. **93**:297 (June 16) 1931.

Vaccination against smallpox was performed on 331 children, with 14 (4.2 per cent) unsuccessful reactions. Of the 14 children who failed to respond to the

vaccination, 12 were revaccinated from four to five days later; 2 exhibited the usual vaccination course, while 10 showed an accelerated reaction. Of 2 children revaccinated on the eighth day after the first unsuccessful attempt, 1 responded with a typical vaccination "take," but the other child again failed to respond. The author believes that the optimal time for revaccination is on the fourth or fifth day.

LEMASTER, Evanston, Ill.

EXPERIMENTAL INVESTIGATIONS ON THE LIMITS OF THE CURATIVE VALUE OF DIPHTHERIA SERUMS. FRIEDRICH SZIRMAI, Arch. f. Kinderh. **94**:45 (July 17) 1931.

Experiments on guinea-pigs indicate that large doses of diphtheria antitoxin may neutralize some of the toxin which has been bound in the tissues, providing the toxin has not been fixed in the cells for too long a time. The use of extremely large doses of antitoxin in malignant diphtheria is advised, as much as from 100,000 to 400,000 units. In severe cases of diphtheria the serum should be given intravenously as well as intramuscularly. The highly concentrated antitoxin is especially serviceable when very large doses are needed. The neutralization of diphtheria toxin by antitoxin in the living organism cannot be determined with mathematical precision because of the individual variation in the affinity of the cells for the toxin and in the ability of the organism to utilize the antitoxin.

LEMASTER, Evanston, Ill.

THE SIGNIFICANCE OF THE ELECTROCARDIOGRAM IN THE PROGNOSIS OF DIPHTHERIA. PAUL VON KISS, Arch. f. Kinderh. **94**:97 (Sept. 11) 1931.

Several case histories of patients with diphtheria are presented to show that the symptoms and physical findings may lead a physician to judge the prognosis incorrectly. In each of these instances the electrocardiographic tracings, by demonstrating the actual condition of the heart muscle, furnished reliable prognostic information as shown by the subsequent course of the illness.

LEMASTER, Evanston, Ill.

TONSILLECTOMY AND THE SCHICK REACTION. D. OROSZ and G. KUGLER, Arch. f. Kinderh. **94**:168 (Sept. 11) 1931.

Of 161 children on whom the Schick test was performed from one to six years after they had had their tonsils and adenoids removed, 80.7 per cent of those between 2 and 6 years of age and 68.7 per cent of those between 6 and 12 years of age responded with a positive reaction. The results were the same in children in whom hyperplasia of lymphoid tissue had occurred following tonsillectomy and adenoidectomy. The authors found no relation between tonsillectomy and the Schick reaction, and hence were unable to confirm the observations of Schick and Topper published in November, 1929.

LEMASTER, Evanston, Ill.

DIPHTHERIA IMMUNIZATION, THE SCHICK TEST AND DETERMINATION OF THE ANTITOXIN TITER OF SERUM. HEINRICH THIELE, Arch. f. Kinderh. **94**:175 (Sept. 11) 1931.

The Schick test was made on 337 children of school age; there were 30.6 per cent positive reactions. The antitoxin titer of the blood serum failed to agree with the results of the Schick test in 20 per cent of the cases. Twenty-seven of 31 pairs of twins gave identical reactions to the Schick test. The antitoxin of Ramon proved to be more dependable and effective in producing immunity than the albuminose-free toxin of Behring, the anatoxin of Behring or the toxoid of Löwenstein.

LEMASTER, Evanston, Ill.

COMBINED SERUM AND CALCIUM THERAPY IN DIPHTHERIA. ELFRIEDE KAESPER, Arch. f. Kinderh. **94**:205 (Sept. 11) 1931.

On the basis of many years of clinical observation Kaesper strongly recommends intramuscular injections of calcium compounds for such complications of diphtheria as edema of the larynx and throat, circulatory insufficiency and serum sickness.

LEMASTER, Evanston, Ill.

THE TREATMENT OF GRIP IN INFANTS AND CHILDREN WITH UNUSUALLY LARGE DOSES OF AMIDOPYRINE. GYÖZÖ PETRÄNYI, Arch. f. Kinderh. **98**:74 (Dec. 13) 1932.

Large doses of amidopyrine were given to children with grip, and excellent results were observed. Children from 2 to 5 years old received 3½ grains (0.2 Gm.) of amidopyrine every two hours until the temperature dropped to normal, and then the interval between doses was gradually lengthened. With this medication the children reacted promptly with improved appetite, rapid drop in temperature and general improvement. No toxic effects were noted from the employment of amidopyrine in the amounts used.

LEMASTER, Evanston, Ill.

ENCEPHALITIS FOLLOWING VARICELLA. PAUL MÜHLENKAMP, Arch. f. Kinderh. **98**:89 (Dec. 13) 1932.

The author reports a case of encephalitis occurring in a 4 year old boy on the fifth day of chickenpox. Consciousness was not lost, but there were signs of irritation of the central nervous system, such as restlessness, intention tremor, ataxia with falling to the right, increased knee jerks, convergent strabismus and jerking movements of the arms and legs. Treatment consisted of repeated spinal punctures. After fourteen days the patient seemed entirely normal except for slowness in speech. The lack of meningeal and psychic symptoms in this patient places this case of encephalitis in that rare class in which there is a combination of acute cerebral tremor and cerebral ataxia.

LEMASTER, Evanston, Ill.

CEREBROSPINAL MENINGITIS IN EARLY INFANCY. W. G. BALABAN and R. N. KRITSCHEWSKA, Jahrb. f. Kinderh. **137**:152 (Nov.) 1932.

A detailed discussion is given of 356 cases of meningococcic infection in children under 4 years of age, in Kiev, from 1926 to 1931, inclusive. The majority of cases occurred between the ages of 6 and 12 months; in 10 the condition was fulminating; in 37 there was a marked septic invasive phase. A rash was observed in 20 per cent of all the patients. Blockage occurred in 15 per cent of the children under 2 years of age. The strain of organism appeared to have little to do with the severity of the various epidemics. In 60 patients reexamined at frequent intervals for long periods, nervous instability was prominent. Thirty-two per cent recovered; 20 per cent were improved; 24 per cent were unimproved, and 24 per cent died. Serum was administered as soon as possible in large repeated doses. In 50 per cent of the cases it had to be injected for a period of two weeks.

CLAUSEN, Rochester, N. Y.

THE USE OF ANTITOXIN PLUS NEOARSPHENAMINE IN MALIGNANT DIPHTHERIA. ELEANORE GLATZER, Monatschr. f. Kinderh. **55**:154, 1932.

During recent years, in Germany, there has been a very malignant type of diphtheria which does not respond to the usual type of antitoxin. The writer attempted the treatment recommended by the Breslau clinic, namely, the combination of antitoxin and neoarsphenamine. The treatment as outlined consists of antitoxin, from 100,000 to 200,000 units given in from four to six days, with intravenous injections of neoarsphenamine in doses of from 0.15 to 0.3 Gm.

daily until a total of from 1 to 1.05 Gm. is reached. The mouth is washed with hydrogen dioxide. The mortality is much lower with this treatment than with antitoxin alone, with which other authors report a mortality of as high as 60 per cent.

GERSTLEY, Chicago.

SOME NONTYPICAL CASES OF SCARLET FEVER EXANTHEM. W. KNOEPFELMACHER, Wien. klin. Wchnschr. **43**:1447 (Nov. 20) 1930.

1. The most important cases of scarlet fever are those without exanthem, i.e., cases which present typical angina without any cutaneous manifestations. When three members of the same family present angina and the fourth presents angina with erythema which is characteristic of scarlet fever, the diagnosis will be scarlet fever for all four patients. 2. Scarlatina miliaris is the mild form of scarlet fever. The exanthem is intensely dark, and the skin is blister-like in places. 3. Another mild form presents a mixture of scarlet fever exanthem with other forms of exanthem, which sometimes simulate urticaria. 4. Toxic scarlet fever is a type in which the prognosis is unfavorable. The exanthem is intense, single spots merging into a diffuse reddening. The color is purple-red, which becomes yellow when the skin is pressed. This type is accompanied by a high temperature, small frequent pulse and continued vomiting. 5. Septic scarlet fever is characterized by a tendency to swellings of the lymphatic glands and rheumatic pains; icterus is frequent. The diseases of the throat, namely, retropharyngeal abscesses and necrotic angina, constitute severe accompanying phenomena. 6. There is also the so-called light scarlet fever. The exanthem is slight; the diagnosis can be made when typical angina, swelling of the follicles and some reddening are present.

ABT, Chicago.

BLOOD CULTURE OF TUBERCLE BACILLI IN CASES OF ACUTE RHEUMATIC FEVER. B. BUSSON, Wien. klin. Wchnschr. **44**:407 (March 27) 1931.

Only cases are considered in which the patient does not present any tuberculous foci or any disease which can be considered etiologically as tuberculous.

The author states that according to Reitter and Löwenstein a large number of cases diagnosed clinically as instances of polyarthritis are caused by tubercle bacilli. The presence of the bacilli can be shown in the circulating blood and in the fluid of the joints in a limited number of cases. The infection as such follows endogenically, as a result of a bacteremia or "hematogenic dispersion."

This hypothesis of Reitter would lead to the acceptance of the following conclusions: Acute and chronic tuberculosis of the joints is a tuberculous disease which originates endogenously. Not only may it present a completely regressive character in the living, but autopsies of patients who died in acute or chronic stages show no pathologic changes in the joints similar to those found in tuberculous processes. The endocarditis which is often present does not have a tuberculous character. Tubercle bacilli are never found in the inflamed cardiac valves.

In order to explain such exceptions to the pathogenesis of tuberculosis, the author presents two assumptions: The invading tubercle bacilli possess an especially low virulence, or the whole inflammatory process is based on a purely toxic cause, such as is the case in other tuberculous toxic diseases in which tubercle bacilli are not found in the blood. The author also proposes to determine the virulence of the bacilli present in the blood by using guinea-pigs or the rabbit's eye method, which he describes in detail.

ABT, Chicago.

PERCUTANEOUS VACCINATION AGAINST TYPHOID. E. LÖWENSTEIN, Wien. klin. Wchnschr. **44**:996 (July 31) 1931.

This paper presents an attempt to work out a percutaneous method for the combating of epidemics. Even now large masses of the population are opposed to injections for prophylactic purposes, while ointments and salves have been in use since time immemorial.

In this investigation the author brings out the following results: (1) There is no more doubt that percutaneous immunization against diphtheria is possible; (2) when using the typhoid bacilli on a rabbit, the author succeeded in producing agglutination by rubbing in corresponding preparations. The latter series of experiments will be continued.

ABT, Chicago.

INFECTIOUS DISEASES (PROPHYLAXIS AND THERAPY). A. BRATUSCH-MARTIN, Wien. klin. Wchnschr. **45**:402 (March 25) 1932.

The author discusses only a few of the most important problems in the field of infectious diseases: 1. Measles. Protection or a milder form of disease can be brought about by the injection of convalescent serum (5 cc.) during the first four days of incubation. Because of practical difficulties in obtaining such serum, its use is limited especially to delicate children, to very young children and to patients with tuberculosis. 2. Epidemic meningitis. Prophylaxis has been unsuccessful. Patients are isolated. Antitoxic serum should be started as early as possible. 3. Poliomyelitis. The treatment differs according to the stage of the disease. In the initial feverish state, which is only seldom diagnosed, specific and convalescent serum should be used, though results are uncertain. When paralysis has occurred and fever has subsided, electricity, hot air and diathermy should be used. The occurrence of contractures should be avoided through passive movements. Further treatment is orthopedic.

ABT, Chicago.

PERMANENT INJURY OF THE CIRCULATORY SYSTEM AFTER SEVERE DIPHTHERIA. A. F. HECHT, Wien. klin. Wchnschr. **45**:865 (July 8) 1932.

It cannot be denied, as has been done previously, that permanent injury of the circulatory system may occur after diphtheria. It is, however, infrequent, and in the most severe case the patient may recover completely after a few months.

Repeated electrocardiographic determinations are necessary for the evaluation of a postdiphtherial injury to the circulation. The electrocardiogram allows a control of the course of the injury and is also valuable for the prognosis. This method, however, fails, and death may ensue even when a normal electrocardiogram is obtained. In such cases one must assume an injury of the vascular wall.

ABT, Chicago.

DIAGNOSIS AND THERAPY OF VULVOVAGINITIS GONORRHOICA INFANTUM. A. FESSLER, Wien. klin. Wchnschr. **45**:1064 (Aug. 26) 1932.

While the diagnosis of acute vulvovaginitis gonorrhoica infantum can be easily made, a differentiation between a chronic vulvovaginitis gonorrhoica and a nonspecific vulvovaginitis is difficult. The author has tried out a serologic method of Müller-Oppenheim. This method has already become indispensable for the diagnosis of gonorrhea and its complications in adults, but has been used comparatively little in children.

According to the author, it is a useful aid for differential diagnosis of vulvovaginitis gonorrhoica. In nongonorrheal vulvovaginitis the reaction is negative almost without exceptions; in gonorrhea it is positive in about 60 per cent of the cases. The positive reaction is of no value for the prognosis of the disease; it may persist after recovery.

The reaction is frequently only slightly or moderately positive; in about 40 per cent of cases of long duration it is negative.

Comparative examinations of vaccinated and nonvaccinated patients have shown that vaccine therapy, even with careful dosage, is without effect.

ABT, Chicago.

CASES OF POSTVACCINIAL ENCEPHALOMYELITIS OBSERVED IN HOLLAND TO JAN. 1, 1929. F. S. VAN BOUWDIJK BASTIAANSE, Ztschr. f. d. ges. Neurol. u. Psychiat. **134**:657 (July) 1931.

Up to the recent report of cases of encephalomyelitis, the chief complications known to follow vaccination were tuberculosis and syphilis, erysipelas, septicopyemia and tetanus. The earliest case which Bastiaanse could find of vaccination followed by encephalomyelitis was in a child who was vaccinated in 1900, at 6 years of age; convulsions and unconsciousness developed, lasting for twelve hours, and following this the patient was paralyzed on one side. Apparently he has recovered, and he shows no ill effects. Another early case was that of a child, aged 6, in whom, in 1903, following vaccination, paralysis of the right side and dementia paralytica of the left side developed, with absence of patellar and achilles reflexes. Since the relation of vaccination to infection of the central nervous system was not appreciated at the time, her trouble was attributed to a slight trauma experienced prior to the illness.

Bastiaanse found the following cases in the foreign literature before 1925: Thaning reported the case of a girl, aged 6, who was vaccinated in school; then there developed a gradually progressive paralysis of all the muscles, with loss of patellar and achilles reflexes, but no other positive findings. The patient gradually regained power in the extremities; all traces of paralysis disappeared, and she completely recovered. In a case of Finkelstein there developed in an infant, aged 1 year, one week after vaccination, hyperesthesias, opisthotonos, slight stiffness and twitchings. All the symptoms disappeared with the drying up of the vaccination lesion. Similar cases were recorded by Freud (1897) and Comly (1906). Luksch (1924) reported 3 cases in which there developed what he thought were encephalitic symptoms ten days after vaccination. The brains showed the changes observed in the acute stages of encephalitis. Luksch was unable to find anything in the cases which was peculiar to the effect of vaccination, though he recognized the relation between the clinical symptoms and the vaccination.

The first cases of the disease in Holland were observed in 1924. One was in a child, aged 5, in whom meningeal signs developed eleven days after vaccination; the child recovered, and the case was diagnosed at the time as encephalitis. The other case was that of a boy, aged 5; headache, coma, meningeal signs, hypertonicity and a Babinski sign developed about one week after vaccination. These cases were reported by Bastiaanse, who suspected some relation to the vaccination, and who asked for similar reports from physicians in Holland. These cases were recorded in a central bureau, and there is available, therefore, a complete list of the cases in the country. Neurologists, internists and pediatricians were enlisted in an effort to report all cases. There has been an effort also to record all cases in infants of from 4 months to 1 year of age who die within a month after vaccination. This is still being done.

There were in Holland up to Jan. 1, 1929, 138 undoubted cases of encephalomyelitis following vaccination. Of these patients, 69 were male and 69 female. The ages ranged from 4 months to 7 years. Forty-three patients died, 23 male and 20 female. In Holland the reaction took place on an average of from seven to nine days after the vaccination, at a time when the pustule was most active. This reaction was not marked. Between the vaccination and the first definite symptoms there was an average incubation period of from nine to thirteen days. The disease set in rapidly, and within a few hours the complete clinical picture had developed. The first symptoms were headache (27 times), vomiting (39 times) and fever (75 times). Immediately following these were disturbances in consciousness (96 times) manifested as drowsiness, somnolence or coma. In addition, there were convulsions (48 times), stiffness of the neck (54 times) and a Kernig sign (39 times). During this and the following period, symptoms and signs appeared which were referable to the pyramidal tract: Babinski sign (76), hypertonia (27) and hemiparesis (8). Spinal cord signs (38 times) were: retention of urine, loss of abdominal, knee and achilles reflexes, paraplegia and flaccid paralysis.

Signs of involvement of the cranial nerves were: ocular palsies (15), facial paralysis (8), ptosis (7) and lingual paralysis (3). Other signs occurred as follows: hyperesthesia (30), trismus (16), marked secretion of sweat (9), hypotonia (5), mental disturbances (6), ataxia (5), tremors (5), opisthotonos (4), choreiform movements (4), nystagmus (3), aphasia (3), catatonia (2) and hemianopia (1). There were mild changes in the spinal fluid in 15 cases.

It has been said that encephalomyelitis following vaccination never occurs before 1 year of age. Bastiaanse analyzed a series of cases at various age levels, ranging from 4 months to 7 years. He concludes that the diagnosis in very young children will always be difficult, because signs like those of Babinski, Kernig and Brudzinski, incontinence and mild paresis have no value, while convulsions occur in all sorts of children's diseases. On the other hand, true forms of the disease may go undetected. If in an infant, fever, vomiting, somnolence, stiff neck, convulsions, paresis, tonus changes, tremors and choreiform movements occur after vaccination, one can establish a diagnosis without question. If the infant dies within a month after vaccination, encephalitis must be considered, even when the signs are referable to other organs. On the other hand, one must not be too hasty with the diagnosis, particularly in cases with fever and vomiting on the seventh day, with or without convulsions, followed first by more or less amelioration and later by typical encephalitic phenomena.

The most important treatment is active vaccine therapy based on the work of Gordon, who showed that the serum of animals inoculated with pox vaccine established a passive immunity against vaccine. If 1 cc. of this serum is injected subcutaneously into a rabbit and then injections of pox virus are made into the rabbit on the next day, no pustules develop. Bastiaanse had such a vaccine prepared in Holland. Of 17 patients treated with a vaccine, 5, or 29.04 per cent, died. The mortality when serum is used is a little higher, therefore, than when it is not used. The number of cases is too small to warrant absolutely final judgment. In any event, there is no particularly favorable effect of serum therapy in these cases of encephalomyelitis. In a case in which serum therapy was instituted, even within twenty-four hours after the onset of the disease, the patient died. Of 3 patients treated with vaccine 1 showed immediate improvement.

Bastiaanse was able to study the brain in 2 cases. Macroscopically, only mild hyperemia of the pia and congestion of the vessels in the white matter were present. Microscopically, the brain showed numerous perivascular foci, chiefly in the white matter, and everywhere in the cerebrum and in the cerebellum, pons, cerebral peduncles and brachia pontis. There were no foci in the cerebral nerves. Perivascular foci were present here and there in the cerebral cortex, chiefly in layers five and six. The foci were not numerous in the basal ganglions. On the other hand, the mesencephalon showed a marked, diffuse increase of cells, particularly in the red nuclei, the substantia nigra and the pontile nuclei.

There is an apparent difference between the foci in the telencephalon, the cerebellum, the peduncles and the brachia pontis, on the one hand, and those in the gray substance of the brain stem, on the other. The foci in the telencephalon and in the white substance of the brain stem are almost entirely perivascular. Where the foci are not found around a vessel in these areas, one can establish a close relationship to a vessel. The perivascular infiltrations are wide and pass over into the white matter imperceptibly. There are no leukocytes; lymphocytes are very few and are either within or immediately around the vessels. Here and there plasma cells are seen. The great majority of the cells around the vessels are microglia and astrocytes. The foci in the gray matter of the cortex have a similar character. No changes were noted in the cortical cells themselves, except for occasional evidence of neuronophagia. The foci in the gray substance of the brain stem have a little different character. In the red nucleus and substantia nigra particularly, one finds numerous degenerated ganglion cells. In these nuclei are areas in which not a single normal ganglion cell is to be found. The blood vessels, on the contrary, show relatively slight perivascular infiltration. Many of them show none, while others have only a mild infiltration within their walls, chiefly of lymphocytes and plasma cells. One gains the impression that the glial

mantle is found mostly in the white matter, and that in the gray the mesodermal reaction is the more pronounced. Weigert preparations show a loss of myelin sheaths around the vessels.

A comparison of Bastiaanse's findings with those of other workers brings out some interesting points: 1. With regard to the spread of the disease through the nervous system, all investigators confirm the finding that the white matter is widely affected. Turnbull and McIntosh (1926) said that the gray matter is more affected than the white, but that the latter is greatly involved. To them the characteristic feature was the demyelinization. Luksch believed that gray and white matter are about equally involved by the inflammatory process. Perdrau said that the white substance of the cerebrum and cerebellum is more involved than the gray. Bouman and Box found the foci chiefly in the white matter; Wiersma also found them most commonly in the white substance, as did Pette. One may conclude, therefore, that there is marked involvement of the white matter, and that in some cases the gray substance is only slightly affected. 2. As to the nature of the foci in the white matter, all investigators agree that those in the white matter are chiefly extra-adventitial. They are wide and pass into the brain substance. They are composed of microglia and some astrocytes containing fat droplets, which are the result of the destruction of the myelin sheaths. 3. There are differences of opinion concerning the involvement of the gray matter. Wiersma reported the most widespread involvement in one of his cases that showed neuronophagia in the pallidum, caudate and thalamus and the entire gray substance. In his 2 cases, Bastiaanse found extensive neuronophagia in the red nuclei, the substantia nigra, the reticular nuclei and the nucleus lemnisci lateralis. Luksch described degeneration of the cells in the substantia nigra. Turnbull and McIntosh often found tigrolysis, but seldom complete necrosis. They found some loss of cells in the anterior and posterior horns in their case 4, but no neuronophagia. Bouman and Box found no changes in the ganglion cells. Several authors have pointed out that the ganglion cells may be entirely normal in the demyelinated areas. It may be concluded, therefore, that although the disease has little tendency to attack the ganglion cells per se, they do not remain unaffected, and in some cases may be markedly affected. 4. Inflammation in the leptomeninges is slight or absent. Turnbull and McIntosh said that it is relatively slight and insignificant. Lymphocytes, plasma cells and hyaline cells are seen around the veins. Perdrau found the infiltration of the meninges very mild, but cell accumulations around the vessels were not uncommon. Wiersma found only hyperemia of the meninges. Bastiaanse found only scattered groups of lymphocytes around the vessels. 5. Inflammatory evidences in the adventitia of the blood vessels are uncommon. Luksch found lymphocytes, plasma cells, polymorphonuclears and endothelial cells in the vessel walls. Wiersma found polymorphonuclears in 1 case. Perdrau found lymphocytes and plasma cells most frequently in the perivascular spaces. According to Turnbull and McIntosh the perivascular foci are composed of lymphocytes, plasma cells and mononuclear leukocytes. 6. The spinal cord has not been studied thoroughly in many cases. Turnbull and McIntosh found inflammatory processes in all levels; they are slight in the upper cervical area, and marked in the fifth cervical level. Inflammation is most marked in the lumbosacral area, where it involves both gray and white matter. Perdrau found the process most intense in the lumbosacral area also. 7. Perdrau found demyelinization in the anterior roots of the ninth thoracic nerve and inflammatory phenomena in the distal end of the left brachial plexus. Perdrau found a mild infiltration of lymphocytes and plasma cells in the spinal ganglions. The optic nerve and tract were injured in Schurmann's case.

Encephalomyelitis following vaccination appeared sporadically before 1924, but instances have been more numerous since than before that time. The average period of appearance of symptoms was eleven days after inoculation. Most of the cases occurred in February and March; the number fell off markedly in May. The number of inoculations does not in itself explain these tendencies, because in October, June and September, when there were as many inoculations and more

than in February and May, the incidence was low. Older children are more apt to be attacked than younger. Males and females are equally affected. Of 191 patients, 91 were males and 100 females. In two instances more than one case appeared in the same family. Often, several patients were inoculated by the same physician, but it must be remembered that in country districts all the work is carried out by a single physician; this may, therefore, mean little. Vaccine virus was used from stations in Paris, Vienna, Bern, Hamburg and other places in Holland, and with every strain, cases of encephalomyelitis followed. In an instance in which vaccine virus imported from Sweden was used, 3 cases of encephalomyelitis developed, whereas following the employment of the same virus used in Denmark not a single case of encephalomyelitis occurred.

As to etiology: 1. One group of investigators look on the vaccine virus itself as the cause of the disease (Luksch, Netter and Jorge), and their belief is that the vaccine virus has become more potent in later years. They lay much stress on the finding of vaccine virus in the brain in a case of postvaccinal encephalomyelitis of McIntosh and Turnbull. Objections to this idea of the etiology of the disease are that rabbits into which injections of vaccine virus have been made have pustules in all organs and possibly least of all in the brain, that the experimental encephalomyelitis differs histologically from that found in man, and that the number of cases has no connection with the virulence of the vaccine. 2. Others believe that the encephalomyelitis is due to another virus, which may be latent in the organism and be aroused to activity by the decreased resistance of the body caused by the vaccination. 3. Others believe that the encephalomyelitis is due to a mixed infection.

ALPERS, Philadelphia. [ARCH. NEUROL. & PSYCHIAT.]

CLINICAL OBSERVATIONS ON TYPHOID FEVER IN INFANTS. Y. YAGI, J. Pediat. (Tokyo), Sept. 20, 1932, no. 388, p. 1695.

Seventeen original cases of typhoid fever in infants are studied, together with 149 others found in the Japanese and foreign literature. The study showed that the disease occurred most frequently in the early summer months, and that the distribution between the two sexes was about equal. The types were (1) simple, (2) toxic, in which gastro-intestinal and encephalitic forms predominated, and (3) meningeal. Over 50 per cent of the cases studied showed initial high fever and early diarrhea, but vomiting during the initial stage was seen in only 32 per cent. Cough was present in 73 per cent. Anorexia, insomnia and convulsions were seen in a few cases. The febrile period lasted for an average of 23.1 days in cases of infection due to Bacillus typhosus and for 20.1 days in cases of infection due to Bacillus paratyphosus.

The fever curves were of continuous type in 31 per cent and of remittent type in 47 per cent. The pulse rate was from 140 to 160 per minute, and in only 1 case was there a relatively slow pulse. The spleen became palpable in 29 per cent of cases. The Widal test was positive in 98 per cent, and the agglutination was between 160 and 640 dilutions. Injection of the pharynx was observed in 69 per cent and albuminuria in 42 per cent. Intestinal hemorrhage was not seen. The mortality was 8.4 per cent in the typhoid and 2.4 per cent in the paratyphoid group.

KATO, Chicago.

Chronic Infections

THE EVOLUTION OF PULMONARY TUBERCULOSIS IN CHILDREN AS REVEALED BY THE ROENTGENOGRAM. HENRY D. CHADWICK, Am. J. Roentgenol. **27**:45 (Jan.) 1932.

The primary lesion may be (1) a circumscribed or more diffuse infiltration, pneumonic in appearance, varying in extent from a few centimeters in diameter to involvement of nearly the entire lobe with or without demonstrable tracheobronchial nodes, (2) a small nodule in the lung with or without visible lymph node

masses in the hilus, (3) circumscribed masses of caseous nodes projecting outward from the mediastinum, (4) masses of calcified tracheobronchial nodes and no obvious lesion of the lung or (5) occasionally an area of infiltration with a rarefied center due to excavation and usually associated with enlarged uncalcified tracheobronchial nodes. In white children it has taken two years for lesions to be well calcified, whereas in colored children well calcified markings have developed in a year. A common mistake is the misinterpretation of the round or oval, homogeneous shadows with clearcut margins, which are usually due to bronchi or vessels on end. It is of prognostic importance to determine whether a given lesion is the type which occurs in childhood or the adult type, and a roentgenologist may not be able to decide from a single observation; in these cases the history and symptoms are usually needed for differentiation. The author emphasizes the importance of the childhood type of tuberculosis from the standpoint of the patient and from that of the public health. Although it is usually benign, it is often the ancestor, sometimes quite remote, of the more serious adult type of tuberculosis. It is known that the adult type of the disease can develop only in tissue which has been rendered sensitive by a preceding infection, and that the lesions caused by the early infection are often the source of the bacilli that produce the pulmonary tuberculosis of later years.

STULIK, Chicago.

THE FIXITY OF THE ATTENUATION OF B C G. A. CALMETTE, Am. Rev. Tuberc. **27**:1 (Jan.) 1933.

Increasing experience confirms the author's original contention that B C G is a fixed virus. Protocols of autopsies of more than 400 vaccinated children are now available. Cultures from lymph nodes had invariably the same attenuated character as the original B C G and were incapable of causing progressive lesions. A number of babies have been inadvertently vaccinated by the subcutaneous injection of enormous doses of B C G, but all have remained in good health. An intraperitoneal injection of the vaccine was given to a hydrocephalic monster. There was no reaction, and no tuberculous lesions were found at autopsy four months later. Against the claims of Petroff and others that B C G brought about a return of virulence stands the fact that thousands of children have been vaccinated without the development of a single pathologic symptom that could be attributed to this organism. However, if, in the future, by means of some laboratory artifice a return of virulence should be brought about, the fact remains that, as it is used today, B C G is a fixed, attenuated virus, always causing the same curable lesions and possessing the same aptitude to immunize the receptive organism against virulent superinfection.

EUGENE SMITH, Ogden, Utah.

PROTECTION AGAINST TUBERCULOSIS WITH B C G IN GUINEA PIGS. KONRAD E. BIRKHAUG, Am. Rev. Tuberc. **27**:6 (Jan.) 1933.

The conclusion reached by Birkhaug as a result of his experiments on animals is that the tuberculinogenic principle of B C G is similar to that possessed by virulent bovine and human tubercle bacilli. He found no appreciable difference in tuberculous guinea-pigs between the cutaneous allergic reactions elicited by tuberculins produced by virulent tubercle bacilli and B C G, whether whole or dissociated into R and S variant colony cultures. The oral administration of B C G in new-born guinea-pigs fails to arouse regularly sensitization to tuberculin or any increased resistance to virulent superinfection. The parenteral administration of B C G is capable of arousing local lesions without producing progressive tuberculous disease. This method of administration also produces sensitization to tuberculin and a significant tuberculo-immunity, which is most marked in animals vaccinated intracutaneously and subcutaneously. Animals vaccinated parenterally with B C G are relatively twice as refractory to progressive tuberculosis following virulent superinfection as nonvaccinated animals. Cultivation experiments demonstrate that B C G may survive in the body of a

guinea-pig as long as five hundred and seventy-seven days without showing any tendency to produce progressive tuberculosis. The parenteral administration of large doses of the colony S is capable of arousing localized lesions without producing progressive tuberculosis.

EUGENE SMITH, Ogden, Utah.

A TAPE TEST WITH TUBERCULIN OINTMENT. ERNEST WOLFF and MAX H. TEITLER, Am. Rev. Tuberc. **27**:308 (March) 1933.

An ointment was prepared containing a highly concentrated tuberculin and killed tubercle bacilli in a base able to penetrate the cutis. The test was made in the paravertebral region between the eighth and eleventh thoracic vertebrae. After cleansing, a drop of the ointment was applied to the skin and covered tightly with a 2 inch (5 cm.) square of adhesive tape. An identical ointment base without tuberculin was applied to the opposite side as a control. The test was read within forty-eight hours. The reaction may be clearly observed ten minutes after the removal of the adhesive tape. A positive reaction is indicated by papules, erythema, induration and yellow pigmentation. The color varies from pale pink to vivid red, according to the intensity of the reaction. The peak of the reaction is reached after seventy-two hours. Medium reactions show definite scaling up to approximately ten days. In nearly every positive case there was some itching over the test area, but systemic reactions did not occur. The agreement between the test with the ointment and the intracutaneous test in all dilutions, as applied to 190 children, was 95.8 per cent. This test is generally comparable in result with the intracutaneous test with old tuberculin in a dilution of 1:100.

EUGENE SMITH, Ogden, Utah.

TUBERCULIN AND THE SCHILLING BLOOD DIFFERENTIAL COUNT IN THE DIAGNOSIS AND CLASSIFICATION OF TUBERCULOSIS. J. F. BREDECK, Am. Rev. Tuberc. **27**:377 (April) 1933.

Bredeck's conclusions are based on the results of the Schilling differential count as observed in 305 cases in which the subcutaneous tuberculin test was used. The value of this combination of procedures lies in the fact that by these means the cellular activity of the blood under the influence of induced focal reactions, as well as general reactions, to tuberculin may be studied. The Schilling count is a more accurate measure of induced focal reactions than is fever, general reactions to tuberculin, physical signs or roentgen observations. The classification of the various stages of activity, as well as those of healing, can best be made by the Schilling count together with the subcutaneous tuberculin test. These measures also provide the most delicate and most accurate method in the diagnosis of early manifest and induced focal activity.

EUGENE SMITH, Ogden, Utah.

THE PRESENT STATUS OF B C G VACCINATION. E. HARRISON NICKMAN, Arch. Pediat. **50**:352 (May) 1933.

The author reviews some of the conflicting opinions concerning the true evaluation of vaccination with B C G, and concludes that such vaccination is not as yet suitable for routine usage as many of the phases are still uncertain. He believes that many years of research may be necessary to determine its value and the best method of its administration, and that there is no necessity for haste in evaluating the true results of this procedure.

WADDELL, JR., University, Va.

TUBERCLE BACILLI IN THE SPUTUM OF CHILDREN FREE FROM MANIFEST PULMONARY TUBERCULOSIS. EMANUEL FRIEDMAN, A. L. ESSERMAN and MERVIN H. BLACK, J. Pediat. **2**:283 (March) 1933.

In a group of sixty children, fifty-one of whom were admitted as preventorium patients and nine for tuberculosis of the joints, only two showed tubercle bacilli in the sputum, as demonstrated by gastric lavage and the injection of the sedi-

ment into guinea-pigs. Forty-four in the group yielded positive tuberculin tests, but only seventeen presented definite evidence of the type of tuberculous infection found in childhood. In no case was there evidence of pulmonary infiltration. In every instance pharyngeal smears and direct examination of the sediment of stomach washings were negative for tubercle bacilli.

LEMASTER, Evanston, Ill.

MULTIPLE-PUNCTURE CUTANEOUS TUBERCULIN TEST. W. S. CRAIG, Brit. M. J. **1**:184 (Feb. 4) 1933.

It is suggested that a test more simple and yet as reliable as either the Pirquet or the Mantoux is a desirable, if not a necessary, adjunct to present diagnostic equipment. As described by the author, "The instrument consists of a short handle carrying at one end five needle points and fitted with a protective cap." The flat end of the instrument is dipped into a bottle containing undiluted old tuberculin, and a drop of the latter is transferred to the surface of the skin. The instrument is held at an angle of 30 degrees, since the needles are of different lengths. Firm pressure is then quickly applied at right angles to the area to be tested, and all the needle points penetrate the superficial layer of skin. The skin is then wiped dry. The advantages of this method are emphasized. The test is compared with others in respect to delicacy; the author thinks that it is more reliable.

ROYSTER, University, Va.

REINVESTIGATION OF CHILDREN PREVIOUSLY EXAMINED BY TUBERCULIN TESTS. W. ERNEST LLOYD and MARGARET MACPHERSON, Brit. M. J. **1**:818 (May 13) 1933.

The authors give in detail the outline of an experimental investigation, which is interesting and informative and which ends with the following summary.

1. After an interval of from one and a half to two years, 700 children, in 164 of whom the cases were contact cases, were retested with tuberculin according to the Mantoux method and were examined for signs of tuberculosis.

2. Investigation has shown that in more than 96 per cent of the cases studied positive reactions have remained positive after an interval of from one and a half to two years. The change from a negative to a positive reaction in at least 37 of 54 cases took place without any notable disturbance in the health of the child.

3. By using dilutions of 1:10,000, 1:1,000 and 1:100 of old tuberculin, it was shown that there is a tendency for the reactions to occur with higher dilutions of old tuberculin after an interval of from one and a half to two years.

4. Seven of the 700 children had pulmonary tuberculosis when first examined, but their condition had improved in 1932. Of the remainder, none has contracted clinical tuberculosis. This number includes 24 who were under 5 years of age when they first showed positive reactions to the tuberculin test, and of these, 2 were less than 2 years of age.

ROYSTER, University, Va.

REACTIVATION OF SCARLET FEVER CARRIERS. K. JONSCHER, Rev. franç. de pédiat. **9**:334, 1933.

The organism which causes scarlet fever may remain at rest or in an inactive state in a person for an indefinite time without being infectious to others. A respiratory infection, however, will transfer this state, so that the person becomes an active carrier of the infection. Therefore, when an infant who has had scarlet fever is seized with a respiratory infection, not only is the condition infectious from the point of view of the immediate pathologic condition, but the patient may be transformed into a carrier of scarlet fever.

SANFORD, Chicago.

ERYTHROCYTE SEDIMENTATION IN INFANTILE TUBERCULOSIS. A. VALLETTE and B. ROSENKRANZ, Rev. franç. de pédiat. **9**:358, 1933.

In infantile tuberculosis the sedimentation speed of erythrocytes is almost constantly increased. If the disease is retrogressing the speed is diminished. This may be of importance, therefore, in giving a prognosis, as it precedes the clinical and roentgenologic signs. It is also accelerated if pneumothorax develops or if a lesion appears in the opposite lung.

SANFORD, Chicago.

CONGENITAL SYPHILIS IN INFANCY. A. SELLEK Y AZZI, Arch. de med. inf. **2**:33 (March) 1933.

Every organ of the child with congenital syphilis can be invaded, with the production of varied symptoms. The serologic test for syphilis ought to be given not to the child only but to the entire family. In the different serologic tests the antihemolytic and precipitating property of the specific serums must be taken into consideration. Serologic reactions and the examination of the spinal fluid are the best indexes, although it must be remembered that in nervous lesions of vascular origin there are no reactions of the spinal fluid. Meningeal and gummatous processes cause positive reactions in the spinal fluid. The curve in the Lange test which is characteristic of congenital syphilis with nervous manifestations of vascular origin is 01210000000, and that following a meningeal process is 01223210000.

SANFORD, Chicago.

SYPHILITIC MENINGO-ENCEPHALITIS IN INFANCY. E. DIAZ ORERO, Arch. de med. inf. **2**:50 (March) 1933.

A case of meningo-encephalitis due to syphilis in a child, aged 8 years, who showed no clinical symptoms on physical examination is reported. The spinal fluid in this case was of a dull color, with a preponderance of polymorphonuclears over lymphocytes. The author states that this is a characteristic condition. The Lange reaction was strongly positive. In such a type of syphilis the serum reaction of all types will be negative for the blood, as well as for the spinal fluid. The colloidal reaction of the spinal fluid is therefore the most sensitive.

SANFORD, Chicago.

CLINICAL FORMS OF HEREDOSYPHILIS WITH AURICULAR INVOLVEMENT. J. C. GROS, Arch de med. inf. **2**:112 (March) 1933.

Heredosyphilis with auricular involvement presents in two ways: first, in late hereditary syphilitic neurolabyrinthitis, and, second, in precocious hereditary syphilitic neurolabyrinthitis. Both these forms lead to deafness and dumbness. In late hereditary syphilis there can be two kinds of accidents: late hereditary syphilitic neurolabyrinthitis and late hereditary syphilitic labyrinthitis. In the latter a great many alterations occur in the central nervous system; this form is least amenable to treatment.

SANFORD, Chicago.

CONGENITAL SYPHILIS IN THE RURAL POPULATION AND MEASURES TO COMBAT IT. MARTIN GONZALEZ-ALVAREZ, Pediatría españ. **21**:1085 (Dec.) 1932.

In a rural pediatric practice in Spain the author found about 3 per cent of his clientele affected with congenital syphilis. He recommended the following measures to combat the disease: (1) the dissemination of educational circulars dealing with the subject of congenital syphilis and the most effective measures known today to combat it, (2) the formation of central depots of antisyphilitic remedies where these remedies are dispensed free to the needy and are always available to the practitioner, and (3) accurate registration of the patients treated and record of treatment given by the physician. Such measures, in the author's opinion, would go far toward diminishing the ravages of this dread social disease.

SCHLUTZ, Chicago.

CALCIFIED SOLITARY TUBERCLE IN THE BRAIN IN TUBERCULOUS MENINGITIS. JOHANNA BORCHARDT, Arch. f. Kinderh. **99**:181 (May 30) 1933.

A roentgenogram of the skull of a boy, aged 7 years, with tuberculous meningitis, showed four small calcified spots. At autopsy these spots were found to be old calcified solitary tubercles in the brain substance. Rupture of one of these tubercles was the cause of meningitis. An old calcified primary lesion in the lung was also seen, but miliary tuberculosis was not demonstrable.

LEMASTER, Evanston, Ill.

SPONTANEOUS PNEUMOTHORAX IN TUBERCULOSIS IN EARLY CHILDHOOD. EVA HESCHL, Arch. f. Kinderh. **99**:215 (June 23) 1933.

Two cases of spontaneous pneumothorax in children, aged 10 months and 2½ years, are reported. Both were due to rupture of a pulmonary tuberculous cavity into the pleural space. In one case spontaneous pneumothorax occurred shortly after an artificial pneumothorax had been done. Autopsy confirmed the diagnosis and the mechanism of occurrence in both patients. LEMASTER, Evanston, Ill.

SYPHILIS AS A CAUSE OF BRONCHIECTASIS. W. MIKULOWSKI, Monatschr. f. Kinderh. **57**:470 (April) 1933.

This is the report of a case in a girl, aged 11 years, in whom bronchiectasis developed following pneumonia and empyema. The possibility of tuberculosis was ruled out. The child was badly syphilitic. The author wonders if the syphilis was the cause of the bronchiectasis by involvement of the elastic tissue or by the formation of fibrosis. GERSTLEY, Chicago.

EXTRAGENITAL SYPHILITIC INFECTIONS OF SIX MEMBERS OF ONE FAMILY. JENÖ FOLLMAN, Boreyoeyaszati **11**:37 (March) 1933.

In six female members of one family, three adults, a child of 12 years and two infants, primary lesions of the tonsils developed. The infection was transmitted in each case through the common use of eating utensils. One of the women was seven months pregnant at the time she became infected and gave birth to a healthy infant. The cases are described in detail, and there is a brief review of the literature dealing with methods of infection in extragenital lesions.

SCHORR, Chicago. [ARCH. DERMAT. & SYPH.]

Internal Diseases

THE SIGNIFICANCE OF OBSCURE ABDOMINAL PAIN IN THE OLDER CHILD. FREDERIC W. SCHLUTZ, J. Pediat. **2**:41 (Jan.) 1933.

Of forty-five cases of abdominal pain in older children, only a few showed definite organic disease, such as syphilis, tuberculosis, heart disease, appendicitis, pyelocystitis, renal stone or peptic ulcer. A history of dietary indiscretion was found in 30 per cent of the patients. Chronic constipation was frequent. The cause of the pain is considered to be enterospasm or meteorism in most instances. This type of abdominal pain unassociated with organic disease is treated by belladonna and a low residue diet, high in protein and low in acid fruits and sugar.

LEMASTER, Evanston, Ill.

PARASITIC INFECTIONS IN NEW ORLEANS BASED ON A CROSS SECTION OF CHARITY AND WELFARE CLINIC PATIENTS WITH SPECIAL REFERENCE TO THE CHILDREN'S CLINICS. ERNEST CARROLL FAUST, J. Pediat. **2**:53 (Jan.) 1933.

A study of four thousand patients in New Orleans during the past four years showed that there was a high incidence of Giardia and Trichocephalus, and a moderately high incidence of Endamoeba histolytica in children of this area, while

the adult population yielded a high incidence of Endamoeba histolytica and Necator and an appreciable incidence of Ascaris and Strongyloides.

LEMASTER, Evanston, Ill.

CHLOROMA. PHILIP ROSENBLUM, J. Pediat. **2**:59 (Jan.) 1933.

A case of chloroma in a 4 year old boy is reported. Bilateral proptosis was extreme. Tumorous nodules were found in the skull bones, sternum, vertebrae and ribs and in many lymph glands. The blood picture remained essentially normal except for moderate anemia. A green color was noticed in only one tumor mass lying near the gasserian ganglion. The literature on chloroma is briefly reviewed. The author favors classifying this case as a sarcoleukosis to indicate the malignant nature of the disease in addition to the systemic involvement.

LEMASTER, Evanston, Ill.

SPONTANEOUS PYELITIS IN THE RABBIT: AN ASCENDING INFECTION IN THE URINARY TRACT; ITS RELATIONSHIP TO THIS DISEASE IN MAN. HENRY F. HELMHOLZ, Surg., Gynec. & Obst. **55**:449 (Oct.) 1932.

Although the existence of pyelitis as an entity has been denied, lack of human material for the study of early cases has left the nature of early lesions and mode of entrance of organisms in cases of colon bacillus infection subject to uncertainty.

In a study of sixty-seven rabbits spontaneously infected, thirty-four with bacilluria and thirty-three with pyuria, the most common pathologic condition found was bacilluria limited to the bladder. Eleven of sixteen cases of infection of the upper urinary tract were cases in which the renal pelvis alone was the seat of infection.

When lesions were produced experimentally, cortical and medullary involvement of the kidney was found to be the rule in hematogenous infections, while infiltration of the wall of the kidney pelvis without inflammation of the parenchyma characterized the cases of ascending infection.

Conclusions are that in the rabbit there is a pathologic condition properly termed pyelitis, and that infection of the pelvis with the colon bacillus proceeds by the ascending route.

GRAVES, New York.

MEGACOLON: EVIDENCE IN FAVOUR OF A NEUROGENIC ORIGIN. W. A. D. ADAMSON and IAN AIRD, Brit. J. Surg. **20**:220 (Oct.) 1932.

The authors advance three theories of megacolon: (1) developmental, (2) mechanical and (3) neurogenic. Clinically the condition of megacolon may be due to a relative sympathetic overaction. No anatomic alteration is found in the extrinsic nerves of the colon, and histologically little change can be observed in the cells and fibers of Auerbach's plexus, so that the lesion would appear to be functional rather than organic.

The authors describe the anatomy and physiology of the sympathetic and parasympathetic nerve supply of the pelvic viscera. Experimental work was done on cats in which there was division of the parasympathetic nerve. In five animals that survived the operation the colon had markedly dilated at the end of ten weeks. Accompanying this dilatation there was hypertrophy of the urinary bladder. This piece of work more or less indicates the neurogenic origin of the condition. Treatment consists of sympathectomy.

SUMMERFELDT, Toronto, Canada.

PLEURAL EFFUSIONS: OBSERVATIONS ON THE PRESENT POSITION OF TREATMENT. EDWARD T. FREEMAN, Irish J. M. Sc., Sept., 1932, p. 535.

Serous effusions are considered first and more extensively. Such effusions are usually tuberculous, especially if one excludes cases of cardiac, renal and malignant origin. When the effusion becomes so great that it embarrasses the patient, it

should be aspirated. Other indications for aspiration are dyspnea, severe pain and lack of absorption persisting over four weeks.

The author reviews the methods advised for removal in various textbooks, and states that because of lack of consistency the methods proposed are not satisfactory. He advises partial aspiration with the introduction of air to provide a pneumothorax, and he believes that the shock is much less and the damage of suddenly stretching a lung which almost surely has active tuberculosis is avoided. He describes a technic and an apparatus devised by him which can be easily handled by the general practitioner and which he considers safe.

In the treatment of tuberculous purulent effusions the author advises replacement by gas, oil or gelatin or the use of early thoracoplasty. When rapid absorption of the gas is desired, the replacement is with oxygen; for less rapid absorption, he uses air.

SNELLING, Toronto, Canada.

CONGENITAL HEART-BLOCK. JANET K. AITKEN, Lancet **2**:1375 (Dec. 24) 1932.

To the thirty-seven cases of congenital heart-block reported in the literature the author adds two new ones. The first case was that of a boy 9 years of age, who had had attacks of "blueness on exertion" with occasional syncope since he was about 1 year old. There was no history of diphtheria, rheumatic fever or any other infection that might account for the heart-block. The heart rate was 40; systolic and soft middiastolic murmurs were heard. The electrocardiogram showed complete auriculoventricular dissociation. A diagnosis of congenital heart-block with patent interventricular septum was made.

The second case was that of a girl of 16 in whom an abnormally slow pulse was noted at the age of 5 or 6. In this case, likewise, there was no history of rheumatic fever, diphtheria, scarlet fever or sore throat. The pulse rate was 48. On auscultation, a soft systolic murmur at the apex and also one over the pulmonic and tricuspid areas were noted. An electrocardiogram showed complete auriculoventricular dissociation. The ventricular rate was 55 and the auricular rate, 97.

The effect of atropine in both cases was to accelerate both ventricles and auricles, but not to interfere with the complete auriculoventricular dissociation.

The cause of the condition is probably the excessive formation of the fibrous tissue which normally develops between the auricle and ventricle, leaving the auriculoventricular bundle as the sole muscular connection between the chambers. The excess of fibrous development interferes with the continuity of the bundle.

LANGMANN, New York.

THE ANATOMY OF ASTHMA AS DISCLOSED BY LIVERPOOL INVESTIGATION. J. B. CHRISTOPHERSON, Lancet **1**:11 (Jan. 7) 1933.

The usual result of the injection of iodized poppy seed oil (40 per cent) is its free entry into the whole bronchial tree. In explanation of this it is suggested that in ordinary cases of asthma the quiescent stage marks the phase of sympathetic action responsible for the relaxation of the bronchial musculature and therefore the opening of the bronchioles. In some cases a permanent dilatation of the bronchial tubes, with beading and varicosity, is seen to have resulted.

LANGMANN, New York.

LIPODYSTROPHIA PROGRESSIVA. A. COCHAYNE, Proc. Roy. Soc. Med. **25**:1732 (Oct.) 1932.

The author reports a case of lipodystrophia progressiva in a girl of 7½ years. The loss of subcutaneous fat was found only in the face.

WILLIAMSON, New Orleans.

A Case of Spontaneous, Nontuberculous Pyopneumothorax in a Nursling. G. Debbasch and A. Santillana, Arch. de méd. d. enf. **35**:726 (Dec.) 1932.

The authors report the case of an infant, 14 months of age, stricken with right lobar pneumonia, severe in type and involving the entire lung. On the third day symptoms of shock suddenly developed, with extreme pallor, a rapid increase in respiratory rate and a harsh, metallic cough. With only slight amelioration, this clinical picture persisted for five days, when the temperature receded by crisis, and recovery was apparently at hand. After two days of apyrexia, however, a septic temperature was initiated with the usual signs of fluid in the right pleura; paracentesis of this area was performed, and 100 cc. of typical pneumococcic pus was withdrawn. The urgency of the syndrome continuing, the baby was removed to the hospital, and further pleural punctures were made. After each of these, during which from 5 to 150 cc. was removed, ethylhydrocupreine, in 5 per cent solution, was introduced in amounts of 3 cc.

The child's general condition rapidly improved, and after the fourth injection roentgenograms demonstrated a marked clearing of the exudate and reduction in the area of the pneumothorax; the patient was discharged twenty-four days after admission. In reviewing the literature available in Tunis, forty-eight similar cases were found, and a high mortality was reported. Amesse, Denver.

The Effect of Arteriotomy on Bronchopneumonia of Infants and Small Children. Selma Meyer and Franz von Zelberschwecht-Laszewski, Arch. f. Kinderh. **93**:30 (March 13) 1931.

Arteriotomy is recommended as an effective method to relieve circulatory congestion in the heart and lungs during pneumonia. The authors believe removal of blood from the radial artery to be superior to venipuncture. Cyanosis, restlessness and the presence of other pathologic conditions do not detract from the effectiveness of arteriotomy. However, in children with weak, thready pulse and paralysis of the respiratory and vasomotor centers, the procedure is without benefit.

LeMaster, Evanston, Ill.

So-Called Acute Aleukemic Reticulitis. E. Podrinec and K. Terplan, Arch. f. Kinderh. **93**:40 (March 13) 1931.

This case report concerns a 1 year old child who suddenly became sick with a high temperature, generalized enlargement of the lymph glands, a palpable spleen, cutaneous petechiae and ecchymoses and ulcerous, necrotic angina. The blood was normal. Death occurred in sixteen days.

Autopsy revealed hyperplasia of the reticulo-endothelial cells of the spleen, bone marrow and lymph nodes as well as similar cells in the lung tissue. Lymphocytic infiltration was found in the liver and heart. The authors interpret the histologic picture as indicating an inflammatory hyperplasia following an acute infection rather than a true aleukemic hyperplasia. LeMaster, Evanston, Ill.

Acute Atrophy of the Liver in Childhood. Karl Rupilius and Olga Müller, Arch. f. Kinderh. **93**:108 (April 10) 1931.

A case of acute yellow atrophy of the liver in a 6 year old boy, with recovery, is reported. The illness began as an acute catarrhal jaundice with slight fever, but suddenly changed into a severe intoxication with septic fever, cerebral symptoms, a palpable spleen and an enlarged liver which later decreased in size. Treatment consisted of rest in bed, warmth and the intravenous use of salt solution and neoarsphenamine. Four fatal cases of acute yellow atrophy of the liver in children under 6 years of age are presented together with the autopsy observations.

LeMaster, Evanston, Ill.

INVESTIGATIONS ON THE BIOLOGIC IMMUNITY IN INFLAMMATION OF THE LUNGS: V. FACTORS AFFECTING THE ORIGIN OF DIFFERENT TYPES OF PNEUMONIA. G. ERÖS, D. GYÜRE and E. KRAMÁR, Arch. f. Kinderh. **93**:161 (May 15) 1931.

Living pneumococci were introduced intratracheally into three groups of rats: Group I had received an intratracheal instillation of a sublethal dose of living pneumococci three weeks in advance. Group II had no known contact with pneumococci, and group III had been given a subcutaneous injection of pneumococcus vaccine three weeks previously. The resulting pneumonia differed greatly in the three groups of rats. In group I a severe confluent pneumonia developed involving an entire lobe or more, with abundant fibrin in the alveolar exudate. Group II, for the most part, showed little involvement of the lungs, with small inflammatory spots and with a serous exudate containing no fibrin, the so-called septic pneumonia. Some of the group III rats presented pneumonic symptoms similar to those of the first group, while others showed only a moderate tendency toward confluence of consolidated patches, which was most marked in the region of the hilus, with enlargement of the hilus glands and peribronchial and perivascular infiltration, as is frequently seen in pneumonia of infants. On the basis of these experiments, the authors conclude that the type of pneumonia is governed to a great extent by the degree of immunity of the animal.

LEMASTER, Evanston, Ill.

THE EFFECT OF PARATHYROID EXTRACT-COLLIP ON THE EOSINOPHIL COUNT OF NORMAL AND EXUDATIVE INFANTS. GEORG LENART and EMIL VON LEDERER, Arch. f. Kinderh. **93**:181 (May 15) 1931.

The eosinophil count of healthy infants varied considerably both above and below normal values during the twenty-four hours after the injection of parathyroid extract-Collip. This irregularity was even more marked in infants with exudative diathesis, and frequently forty-eight hours or more elapsed before the eosinophil count returned to normal. It is suggested that this instability of the eosinophil count under the influence of parathyroid extract-Collip is comparable to the known lability of the water content of the body in infants and especially in those with exudative diathesis.

LEMASTER, Evanston, Ill.

THE VALUE OF THE CONCENTRATION TEST IN THE SYMPTOMATOLOGY OF EXUDATIVE DIATHESIS. JULIUS KÖNING and EMIL VON LEDERER, Arch. f. Kinderh. **93**:216 (May 15) 1931.

Normal infants pass urine of gradually increasing concentration during the night when fluid and food are not ingested. However, in eight infants with an exudative diathesis specimens of urine obtained every half hour during the night showed increasing concentration the first few hours and then a sudden spontaneous drop in specific gravity, usually followed by the passage of more concentrated urine again before the end of the period of observation. The authors consider this irregular concentration curve to be characteristic of the exudative diathesis, and believe that it is to be correlated with the known lability of the water content of the body and the wide daily variations in body weight frequently seen in these infants.

LEMASTER, Evanston, Ill.

PNEUMONIA OF CHILDHOOD: III. PLEURAL EMPYEMA. H. KOCHMANN, Arch. f. Kinderh. **94**:159 (Sept. 11) 1931.

Of the 450 children with pneumonia, empyema developed in 88. One third of all cases of empyema occurred in infants, one third in children between 2 and 3 years of age and the remaining one third in children over 4 years. The mortality was 75 per cent in the cases in which the empyema occurred with lobular pneumonia, while it was only 15 per cent when the empyema arose as a complication of lobar pneumonia.

Frequently empyema could not be diagnosed from physical findings or roentgenograms of the chest in the case of infants during the course of bronchopneumonia, because of the small amount of fluid in the pleural cavity. Seventy patients with empyema were treated, with 22 deaths. Repeated chest aspirations and irrigations without operation were employed in 23 children. In cases in which simple aspirations failed to cure, intercostal incision and insertion of a short metal tube were performed. The treatment of persistent fistulas consisted of roentgen visualization of the abscessed cavity after injection of Beck's paste and operative procedures as indicated, such as rib resection and fixation of the lung to the chest wall. Iron and arsenic tonics, fresh air, rest and sunshine are recommended as supporting measures.

LeMaster, Evanston, Ill.

What Becomes of the Children with Hirschsprung's Disease? K. C. Chaudhuri, Arch. f. Kinderh. **97**:29 (July 22) 1932.

The author presents the clinical course and roentgen findings for the children with Hirschsprung's disease who have been under his care. He emphasizes the wide variation in the severity of symptoms and pathologic changes. Hirschsprung's disease is recognized early by a history of constipation, together with roentgenologic evidence of increased length or change in position of the sigmoid bowel. Most of the patients were treated medically. In the series of this clinic, in one fourth of the cases the patients died, in one fourth the condition was unchanged, in one fourth the patients were improved and in one fourth they were cured.

LeMaster, Evanston, Ill.

The Lobus Venae Azygos in Childhood. D. Oroz, Arch. f. Kinderh. **98**:42 (Dec. 13) 1932.

The azygos lobe, first described by Velde in 1927, consists of a portion of the upper field of the lungs demarcated by a cleft produced by an anomalous course of the azygos vein. Among nine hundred roentgenograms of the chests of children between 2 and 14 years of age, the author found five examples of this condition. Two additional cases discovered by Professor Duzár are presented. In producing the azygos lobe, the azygos vein may run horizontally, separating the apex of the lung; it may be directed vertically, splitting the apex in half, or it may lie in the mediastinum, demarcating only a tongue-shaped region of the medial surface of the lung. The presence in the roentgenograms of a bulbous swelling at the lower end of the lobe is diagnostic. The author adds a fourth case to the three previously reported in which a collection of fluid occurred in the azygos fissure.

LeMaster, Evanston, Ill.

The Clinical Picture of Scheuermann's Disease: Osteochondritis Deformans Juvenilis Dorsi. Friedrich Eckardt, Arch. f. Kinderh. **98**:81 (Dec. 13) 1932.

A case of Scheuermann's disease in a 14 year old boy is reported. For one and one-half years the boy had complained of moderate pain in the back. Roentgenograms showed rarefied, irregular patches in the edges of the lumbar and lower thoracic vertebrae, without kyphosis or collapse. The tuberculin and Wassermann tests were negative, and the results of calcium and phosphorus determinations on the blood were within normal limits. The author considers the pathologic process to be the same as that in Perthes' disease of the hip joint. Treatment consists of rest in bed, with eventual wearing of a back brace when ambulatory, and such general measures as fresh air, rest, cod liver oil and sunshine.

LeMaster, Evanston, Ill.

DIAGNOSIS OF INTUSSUSCEPTION. A. GRIDNEV, Arch. f. klin. Chir. **169**:107 (Jan.) 1932.

The author discusses intussusception in adults and in children and reports the cases of two children. One was a 12 year old girl who had been sick for three weeks with abdominal pains, vomiting and bloody diarrhea. A mass could be felt in the right side of the abdomen. Laparotomy was performed, with resection of the bowel and anastomosis of the last portion of the ileum with the transverse colon. Recovery took place in fourteen days. The other case was that of a 1 year old infant with apparent abdominal pain for eighteen hours, vomiting and increased activity of the bowel, the stool containing blood and mucus. A mass could be felt in the abdomen. Laparotomy, with reduction of the invagination, was performed, with recovery in eight days.

In small children the diagnosis depends on the symptoms accompanying acute obstruction of the bowel, especially when blood and mucus in the stool are associated with the finding of a tumor in a patient showing evidence of shock.

S. E. KOHN, Milwaukee.

SURGICAL ASPECT OF HENOCH'S PURPURA. E. SEIFERT, Beitr. z. klin. Chir. **154**:575, 1931.

The author describes three cases showing the surgical aspect of this medical condition: (1) subserous bleeding in the end of the ileum in an adult as a variety of Henoch's purpura; (2) genuine purpura abdominalis in a child operated on for appendicitis (bleeding spots in the wall of the intestine caused rigidity and pain); (3) association of purpura with intussusception (after a successful operation, the child failed, because at autopsy there was subendocardial hemorrhage in the bundle of His).

RUBIN, Boston.

ANAPHYLACTIC SHOCK FOLLOWING TRANSFUSION OF BLOOD. E. TRAUM, Deutsche Ztschr. f. Chir. **237**:96 (Aug. 17) 1932.

More or less severe anaphylactic shock has been reported following repeated transfusions in a recipient when the transfusions have been given from the same donor, even though both were in the same blood group. Such results have probably been due occasionally to errors in blood grouping. Information is lacking regarding the interval of time which must elapse in order to avoid the danger of anaphylactic shock with repeated transfusions in the case of the same donor and recipient. The author reviewed two cases previously reported which gave information on this point. One was the case of an 8 year old child who bore a first transfusion from his father very well, but in whom anaphylactic shock developed when a second transfusion was given twenty-one days later. The second case was that of a woman, aged 50 years, who tolerated two transfusions from the same donor but reacted with anaphylactic shock to a third transfusion from this donor fourteen days after the second transfusion. The author reported the case of a hemophiliac person, aged 29 years, who had received a transfusion from a sister of the same blood group seventeen and a half months previously. He implied, but did not state specifically, that cross-agglutination reactions had been carried out. Anaphylactic shock occurred during the course of the transfusion. In the three cases mentioned the recipients recovered. The author advised that when repeated transfusions must be given, a different donor should be used each time.

GLASER, Rochester, N. Y.

TOTAL AGENESIA OF THE EXOCRINE PORTION OF THE PANCREAS. S. A. SIWE, Deutsches Arch. f. klin. Med. **173**:339 (July 25) 1932.

The author presents a carefully prepared case report of a mentally and physically underdeveloped child who died of a respiratory infection at the age of 2 years.

According to the history, the baby began to have bulky, gray, greasy stools after a period of diarrhea at the age of 6 months. The stools contained large quantities of fat, chiefly neutral fat. The urine showed decreased excretion of nitrogen but was always free from reducing substances. Dextrose tolerance tests gave normal results. At autopsy, there was almost total agenesia of the exocrine portion of the pancreas without demonstrable damage to the insular portion. There were also early cirrhosis of the liver and enlargement of the spleen.

DOOLEY, Kent, Conn.

EFFECT OF ADMINISTERING SUGAR IN ATTACKS OF TACHYCARDIA IN CHILDHOOD. E. SCHÄDRICH and G. W. PARADE, Jahrb. f. Kinderh. **137**:141 (Nov.) 1932.

A 12 year old boy suffered from attacks of paroxysmal tachycardia of increasing severity, during which the clinical symptoms suggested hypoglycemia. By the Hagedorn-Jensen method, the blood sugar was found to be 17 mg. per hundred cubic centimeters. The intravenous injection of 50 cc. of a 20 per cent solution of dextrose promptly and invariably stopped the attacks; if 30 Gm. of dextrose in 200 cc. of water was given in time, by mouth, it also stopped the attacks, but caused nausea. Electrocardiographic analysis revealed an abnormal pace-maker, with a rate of from 160 to 300 per minute; cessation of the attacks was accompanied by partial heart block.

CLAUSEN, Rochester, N. Y.

THE TREATMENT OF CONSTIPATION IN CHILDHOOD. FRIEDRICH LEHNERDT, Kinderärztl. Praxis **4**:145 (April) 1932.

Pseudoconstipation in breast-fed infants is frequently caused by undernutrition due to too little milk, habitual regurgitation, pylorospasm or rumination. If the infant is well nourished but has a bowel movement every second or third day, it may still be normal and require no treatment. If, however, intervention is necessary, the author recommends the ingestion of 100 Gm. daily of a 10 per cent solution of a soup containing malt extract, white flour, cow's milk and potassium carbonate, or if necessary the replacing of one nursing with such a soup. Fruit juices and fruit pulp are also of great value. Obstipation in breast-fed infants, if not due to undernourishment, is usually caused by faulty food. The alkalinizing components of the food (calcium salts and proteins) should be reduced and the acid-builders (fat and carbohydrate) increased. In simple milk dilutions, a second carbohydrate may be added in the form of cereal waters; or the total amount of milk may be reduced and the amount deducted replaced by increased carbohydrate, such as the original formula for the soup suggested. After the first six months of life, the greatest cause of constipation is too much cow's milk. Five hundred cubic centimeters of cow's milk a day is sufficient for any child. Proper training is important in establishing the habit of regular bowel movements. Raw fruit, agar-agar and liquid petrolatum may be necessary.

HUENEKENS, Minneapolis.

PNEUMOCOCCIC PERITONITIS. OTTO LOEWE, Kinderärztl. Praxis **5**:200 (May) 1932.

The differential diagnosis between severe appendicitis and pneumococcic peritonitis is as difficult as it is important, because the former demands immediate surgical intervention, while in the latter conservative measures are indicated. The most important characteristic of pneumococcic peritonitis is that it occurs almost exclusively in young girls, from 3 to 13 years of age, most often about the seventh year. In twenty-nine cases reported from the Anschuetz clinic all the patients were girls, and eleven of them were 7 years old. The onset is sudden as in appendicitis but much more severe. While even severe appendicitis begins as a localized disease, in pneumococcic peritonitis the systemic reaction is as marked

as the abdominal symptoms. The clinical picture presents a combination of appendicitis and typhoid, with a temperature of 104 F. and a leukocyte count of from 30,000 to 35,000, 90 per cent of the cells being neutrophils. The most alarming symptom is the rigid, swollen and painful abdomen. Almost without exception this is accompanied by diarrhea, which would be more important in the differential diagnosis if an occasional case of appendicitis did not present the same symptom. When the diagnosis of pneumococcic peritonitis can be made, operation should be deferred until the acute stage has subsided and a localized walled-off abscess has resulted. At this stage the abdomen may be entered and a drain inserted. After this stage the prognosis is fairly good, although empyema, otitis media or septic abscesses may be complications.

The author reports nine cases. Eight patients were subjected to early operation, with six deaths, and the one patient who was treated conservatively recovered. He cites from the literature twenty-one cases of early operation, with twenty deaths, and forty-three cases in which operation was performed in the subacute stage, with only three deaths.

HUENEKENS, Minneapolis.

PURULENT PERICARDITIS WITH TRACHEAL STENOSIS ASSOCIATED WITH INFLUENZA. SIEGFRIED BAUMEYER, Monatschr. f. Kinderh. **55**:123, 1932.

The author reports the cases of two children, aged 2 and 4 years, who were taken ill suddenly with signs of tracheal obstruction. The clinical picture developed rapidly into that of general sepsis due to the influenza bacillus. The prominent symptoms other than the stenosis were those of pericarditis, pneumonia and meningitis.

At autopsy no membrane was found in the larynx, but the mucosa was reddened and edematous. The writer believes that the signs of obstruction were occasioned by the combination of the pneumonia and pericarditis with the somewhat edematous pharyngeal mucosa.

GERSTLEY, Chicago.

INTESTINAL POLYPS REVEALED BY ROENTGEN EXAMINATION. E. NEDELMANN, Monatschr. f. Kinderh. **55**:192, 1932.

The author reports the case and presents roentgenograms of a 7 year old girl suffering with chronic diarrhea. A picture was taken with a barium sulphate enema, following which the barium was released and air was injected into the intestine. A second roentgenogram revealed the intestine studded with polyps. The child was taken from the clinic and could not be followed.

GERSTLEY, Chicago.

RHEUMATIC POLYARTHRITIS IN INFANCY. G. TOROK, Monatschr. f. Kinderh. **55**: 197, 1932.

The author reports a case of rheumatic polyarthritis in a 3½ month old infant and presents photographs. The course was identical to that in the older child, the condition spreading from joint to joint and remaining in each only a few days. The heart was not involved.

GERSTLEY, Chicago.

PATHOLOGICO-ANATOMIC PICTURE OF FEBRILE RHEUMATISM: VI. CHRONIC POLYARTHRITIS (INFECTIOUS ARTHRITIS, POLYARTHRITIS LENTA) AND RHEUMATIC STIGMAS. F. KLINGE and N. GRYZINCK, Virchows Arch. f. path. Anat. **284**:646, 1932.

The authors have continued their work on rheumatic disease as a clinical and pathologico-anatomic entity due to an allergic reaction of the organism. This paper contains the description of a thorough histologic examination of the organs of thirteen patients in which the different histologic manifestations of chronic polyarthritis in the various stages could be found. The authors realize that the

typical manifestations of acute rheumatic disease, such as edema, infiltration and granuloma, cannot regularly be found in chronic rheumatism. However, they are not entirely missing. On the other hand, the synovitis which is the most striking symptom in chronic polyarthritis is present to a less marked degree in the acute form of the disease. Nodules are present both in the acute and in the chronic form of the disease. Other rheumatic stigmas are the sclerotic lesions of the endocardium, myocardium and pericardium. The scars of endocarditis, perivascular scars in the heart muscle and adhesions of the pericardium in association with rheumatic nodules are described as typical rheumatic stigmas which even in the absence of a history of rheumatism allow the diagnosis of that disease to be made.

In agreement with the clinician, acute rheumatic disease is considered as a purely allergic reaction, whereas in the chronic form of the disease, in the anergic stage, chronic sepsis caused by moderately virulent streptococci with or without a focus of infection is of prime importance. This conception of the disease together with the histologic results does not permit a differentiation between acute and chronic rheumatic polyarthritis as different entities.

SCHOENTHAL, New York.

DIABETES MELLITUS IN CHILDREN. R. WAGNER, Wien. klin. Wchnschr. **44**: 808 (June 19) 1931.

From his observations on 120 diabetic children during the last eight years, the author discusses several points in the treatment.

Some cases accompanied by glycosuria present diagnostic difficulties. They appear in the literature under the names of diabetes innocens, renal glycosuria and diabetes levissimus. An alimentary glycemia curve is the only certain means of distinguishing between these conditions and diabetes mellitus. The general pediatrician is often called on to give first aid to the diabetic child in: (1) precoma and coma; (2) intercurrent infection, and (3) insulin shock. Priesel and Wagner treat coma with fasting, increased dosage of insulin and intravenous injections of fluids. For intercurrent infection, fasting, a diet of fruit and the continuation of treatment with insulin are imperative. Insulin shock is more frequent in children than in adults. In case a child is hypersensitive to insulin a certain sugar secretion can be allowed, though in general it is very desirable to keep the diabetic person sugar-free.

The outlook for the future of the diabetic child the author considers to be much better now than prior to the discovery of insulin, if a strict diet is maintained.

ABT, Chicago.

ASTHMA IN CHILDREN. F. HAMBURGER, Wien. klin. Wchnschr. **44**:1249 (Oct. 2) 1931.

The use of epinephrine in asthmatic attacks of children gives excellent results. Asthmolysin can also be used. The dosage is 0.1 cc., and at the most 0.8 cc. in exceptional cases. The action follows in about fifteen minutes, and all symptoms usually disappear after about thirty minutes. The drugs only relieve the attack and do not affect the predisposition to asthma.

ABT, Chicago.

REPLY TO THE NOTE BY HAMBURGER ON ASTHMA IN CHILDREN. R. LEDERER, Wien. klin. Wchnschr. **44**:1249 (Oct. 2) 1931.

Hamburger is evidently dealing with the attacks of asthma of older children. The author observed an inefficiency of epinephrine in asthmatic attacks of infants. He quotes from Tuscherer (*Jahrb. f. Kinderh.* **127**:64, 1930): "It seems as if epinephrine acts only on adults and older children; in no case is it valuable in asthma of infants. . . . At any rate it has been shown that epinephrine does not relieve the asthmatic attack in infancy."

ABT, Chicago.

HISTOLOGIC MANIFESTATIONS OF ALLERGY. R. RÖSSLE, Wien. klin. Wchnschr. **45**:609 (May 13) 1932.

The author reports the results of experiments on local hypersensitivity which is expressed as hyperergic inflammation.

The author further describes experiments to determine the relationship between the local and general hypersensitivity phenomena. He as well as other workers observed granuloma-like foci as histologic expressions of alteration of tissue. Klinge explains his results as rheumatism-like changes of the tissue. Klinge's work on the early stages of rheumatic granulomatosis in human beings has shown that granuloma considered pathognomonic for the rheumatic alterations of the tissue is only a later stage in the development of a specific process. This is preceded by a so-called early rheumatic infiltration, which supports the assumption that febrile rheumatism in human beings, which represents a systemic disease of the mesenchyma, is an allergic disease, for this change corresponds to the allergic histologic change, and, in particular, to the fibroid infiltration of connective tissue.

ABT, Chicago.

IS DIETARY TREATMENT NECESSARY FOR THE DIABETIC CHILD TREATED WITH INSULIN? RICHARD WAGNER, Wien. klin. Wchnschr. **45**:949 (July 22) 1932.

From his observations on children treated with insulin during the last ten years, the author concludes that a very detailed diet is necessary to maintain the youthful diabetic patient in the best condition. He opposes the frequently expressed opinion that with the simultaneous use of insulin it is unnecessary to keep the diabetic child on a diet.

A diet rich in carbohydrates and poor in fat content is preferred by children, according to the author's experience, though not by those who demand bread and butter between meals. For such children the fat content of the diet must be somewhat increased and carbohydrates decreased.

ABT, Chicago.

FIVE CASES OF CHLOROMA. I. YASUDA, J. Pediat. (Tokyo), Aug. 20, 1932, no. 387, p. 1445.

The author reports five cases of chloroma seen in the pediatric clinic of the Osaka Imperial University. The ages of these patients were 9 (male), 8 (female), 7 (female), 5 (male) and 2 (male) years, respectively. The course was from one and one half to four months. The origin of the tumor was on both sides of the temporal bones in all cases, with also an early involvement of the orbital fossae, the parietal bones and the spines. The upper and lower jaws and the frontal bones were also simultaneously involved in some cases. All these cases were myelogenous in type, as the leukocytes showed the appearance of a large number of immature myeloid cells, including from 5 to 8.8 per cent of neutrophilic myelocytes, and from 27.3 to 70.2 per cent of myeloblasts. The total leukocytic count was from 54,700 to 226,000. The erythrocytes were between 1,420,000 and 2,150,000. There was a relative decrease of mature polymorphonuclear neutrophils as well as of lymphocytes in all these cases. Histologic examination of the tumor tissue in the oldest boy showed a smooth green color and closely packed myeloid cells with fibrillar interstitial tissues.

KATO, Chicago.

Nervous Diseases

STREPTOCOCCIC MENINGITIS WITH RECOVERY. EDWARD LEWIS, Arch. Pediat. **49**:632 (Sept.) 1932.

A case of streptococcic meningitis, probably of otitic origin, with recovery in a child aged 8 years is reported. Treatment consisted in repeated spinal drainage, transfusion and removal of the focus of infection.

WADDELL, University, Va.

POLIOMYELITIS IN THE STATE OF NEW YORK IN 1931. F. W. LARDLAW, J. A. M. A. **99**:1062 (Sept. 24) 1932.

In the 1931 outbreak of poliomyelitis in New York the fatality rate was lower than that for any previous outbreak in upstate New York. Experience indicates the advantage of making a diagnosis in the preparalytic stage, of utilizing laboratory methods and of using convalescent serum even in rural districts. A conclusive judgment on the value of convalescent serum could not be formed.

BONAR, Salt Lake City, Utah.

MEDICAL ASPECTS OF CHILD BEHAVIOR. ESTHER L. RICHARDS, South. M. J. **26**:11 (Jan.) 1933.

The author points out that maladjustments in school children, which may manifest themselves as lying and stealing, etc., may arise as the result of unrecognized physical and mental handicaps or temperamental endowments. The physician who considers the mental health of such patients should be reasonably acquainted with the educational, psychologic and psychiatric aspects of child health.

She states that there is need for more centers where psychologist, pediatrician, psychiatrist, educator, social worker and public health nurse can work together shoulder to shoulder.

TREATMENT OF CHOREA. ALFRED A. WALKER, South. M. J. **26**:125 (Feb.) 1933.

The author recommends the use of commercially combined typhoid-paratyphoid vaccine. This is given intravenously, starting with an initial dose of 0.2 cc. A chill and marked fever usually follow. During the reaction, the choreiform movements become more pronounced and the patient is uncomfortable. The succeeding doses are determined by the degree of reaction obtained. If the temperature is 105 F. or above, the same dose is repeated the following day. If the reaction is less, as indicated by the height of the temperature, the dose is doubled, and 0.4 cc. is given. To maintain a satisfactory febrile reaction, it is usually necessary to increase each succeeding dose, and there is a great variation in the amount necessary. The duration of the treatment is usually from a week to ten days.

The effect of the reaction on the chorea is immediate, as a rule, and the movements are markedly diminished. Improvement continues after each succeeding treatment. All of the cases reported were severe.

SCHLUTZ, Chicago.

PROGRESSIVE PSEUDOHYPERTROPHIC MUSCULAR DYSTROPHY. ALLEN F. VOSHELL, South. M. J. **26**:156 (Jan.) 1933.

The author reports a series of fourteen cases in which the patients were treated with two different methods. One was the treatment with epinephrine and pilocarpine first reported by Kure and Okinaka of Japan. This method of treatment consists in the injection subcutaneously of from 0.2 to 0.3 cc. of a 1:1,000 solution of epinephrine and of 0.1 cc. of a 1 per cent solution of pilocarpine hydrochloride daily, or every other day, until sixty doses have been given without interruption.

The other method, introduced by Milhorat and his associates, consists in the administration of glycine with the idea that this substance will affect the creatine metabolism. The patient is fed a daily quantity of about 5 Gm. of glycine for eight periods of three months each with three weeks intervening between the periods.

The author obtained better results with the pilocarpine-epinephrine treatment, although he feels that his series of patients treated by the glycine method is not large enough to indicate the value of this method. He feels that studies of the phosphocreatine metabolism will indicate some better preparation which will act on a sounder physiologic basis. He points out that these patients rapidly retrogress under rest and that, as the stimulation of muscle activity is essential to the retention of a minimum of function, such patients should not be put to bed unless absolutely necessary.

SCHLUTZ, Chicago.

TWO CASES OF EPIDURAL SUPPURATION. JAROSLAV PROCHASKA, Časop. lék. česk. **70**:1734 (Dec. 18) 1931.

Two cases of epidural inflammation are reported in detail, including the findings at autopsy. Clinically, one progressed like ascending paralysis of Landry and the other like tuberculous meningitis.

STULIK, Chicago.

REACTIONS OF THE SPINAL FLUID TO RIVALTA AND PAVLOVIC SOLUTIONS. BOZENA VRANA, Časop. lék. česk. **70**:1749 (Dec. 18) 1931.

The Rivalta solution consists of the addition of 3 drops of glacial acetic acid to 100 cc. of distilled water, and the Pavlovic solution consists of the addition of 6 drops of glacial acetic acid and 5 cc. of a 10 per cent solution of potassium ferrocyanide to 100 cc. of distilled water. A positive reaction is the cloud produced in the wake of the descending drop of spinal fluid dropped into either solution. The author studied eighty-seven cases for reactions to the Pandy, Ravaut, Siliquid, Rivalta and Pavlovic tests. Of twenty-six patients with tuberculous meningitis, all gave positive reactions to the Pandy, Siliquid and Pavlovic tests; twenty to the Ravaut test, and four to the Rivalta test. Of seventeen patients with purulent meningitis, all gave positive reactions to the Pandy and Siliquid tests; sixteen to the Pavlovic test; eleven to the Ravaut test, and two to the Rivalta test. Of twenty-two patients with cerebral syphilis, all gave positive reactions to the Pandy and Siliquid tests; fourteen to the Ravaut test, and seventeen to the Pavlovic test; not one gave a positive reaction to the Rivalta test. Of four patients with anterior poliomyelitis, all gave positive reactions to the Pandy and Siliquid tests and two to the Ravaut test; none gave a positive reaction to the Rivalta or to the Pavlovic test. Of two patients with meningism, both gave positive reactions to the Pandy and Siliquid tests; one a negative reaction to the Rivalta test, and one positive reactions to the Ravaut and Pavlovic tests. Three patients with tumor of the brain gave negative reactions to the Rivalta test and positive reactions to the Pavlovic test. Three patients with epilepsy gave negative reactions to the Pavlovic test and positive reactions to the Rivalta test. The author deduces that a negative reaction to the Rivalta test tends to rule out purulent meningitis. A negative reaction to the Rivalta and positive reactions to the Pavlovic, Pandy and Ravaut tests speak for tuberculous meningitis. Negative reactions to the Rivalta and Pavlovic tests rule out purulent meningitis and tuberculous meningitis. Positive reactions to the Rivalta, Pavlovic, Pandy and Ravaut tests indicate purulent meningitis.

STULIK, Chicago.

PHARMACODYNAMIC STUDY OF THE VEGETATIVE NERVOUS SYSTEM IN CHILDREN. LYDIE HEJMOVSKA, Časop. lék. česk. **70**:1806 (Dec. 18) 1931.

Eighteen children were studied with respect to dextrose tolerance, reaction to pilocarpine and reaction to epinephrine. No striking reactions were found, in spite of the presence of such classic entities as asthma (vagotonia) and vagotonic intestinal cramps. The author feels that either the vegetative nervous system has a wide physiologic range or the present method of testing is possibly inadequate; also, that the reaction is possibly modified by other factors, such as synergy of hormones, potassium, calcium or hydrogen ion concentration, colloidal reaction of the cells and general metabolic reaction.

STULIK, Chicago.

HEINE-MEDIN DISEASE (CEREBROSPINAL PALSY) IN A SMALL EPIDEMIC IN SLOVAKIA DURING 1931. ALOJZ J. CHURA, Časop. lék. česk. **70**:1809 (Dec. 18) 1931.

The review of the literature includes the poliomyelitides. Wickman divides the cases into the following types: spinal, progressive (Landry), bulbar, pontile, encephalitic, ataxic, neuritic, meningeal and abortive. The last may be a general

type, a meningismus with an influenza-like complex or with a gastro-intestinal complex. The outlines of contemporary treatment are discussed. A map showing the incidence of cases is presented. A bibliography is given.

STULIK, Chicago.

Diseases of the Eye

DIAGNOSIS AND DIFFERENTIAL DIAGNOSIS OF MEGALOCORNEA AND ITS PIGMENT DISPERSION, INCLUDING THE KRUKENBERG-AXENFELD SPINDLE. B. KAYSER, Klin. Monatsbl. f. Augenh. **89**:770 (Dec.) 1932.

The question of whether megalocornea occurs as an idiogenous, congenital anomaly has been settled in the affirmative by the publication of two family trees, one reported by Kayser, with bilateral megalocornea in seventeen members, and the other by Groenholm, with the same condition occurring in thirteen members. Complete coincidence of the symptoms was found in the sixty eyes. Hydrophthalmos was absent. Only males were afflicted, and every case was bilateral and complicated by regular astigmatism. The radius of the curvature of the cornea was equal to or smaller than the normal average, and the anterior chamber was deep. All the eyes were free from pathologic changes, and the subjects were healthy. Kayser, in commenting on the typical appearance of eyes with megalocornea, quoted a similar impression gained by Groenholm, who remarked on their brightness and beauty in contrast with hydrophthalmic eyes.

The symptoms enumerated, which were observed also by Gerty in the case of two brothers who, like two brothers of their mother, had megalocornea, totally exclude hydrophthalmos; their presence or absence are valuable aids in establishing a differential diagnosis. In one instance only was the malformation transmitted from mother to daughter in an otherwise gynophore type of heredity.

In one of Kayser's patients gerontoxin began at the age of 10, and bilateral Krukenberg-Axenfeld spindle at the age of 23 in one eye and at the age of 25 in the other. These two eyes, furthermore, showed irregularly scattered pigment on the anterior surface of the iris, especially in the furrows which form on contraction of the iris. This phenomenon, never described before, and the observation that the spindle increased in width when a large amount of pigment was present prompted Kayser to the opinion that the spindle is not a firmly established formation. He thinks that the pigment originates from the posterior surface of the iris, settles loosely on the posterior surface of the cornea and is carried by the circulation of the aqueous humor to the anterior surface of the iris. Particles of pigment of the spindle embedded in the endothelial cells of the cornea will, of course, remain there. Why this scattering should take place only in otherwise healthy eyes with megalocornea and not in hydrophthalmos cannot be explained.

STOLL, Cincinnati. [ARCH. OPHTH.]

TREATMENT OF CORNEAL ULCERS WITH BRILLIANT GREEN. D. G. PTASHNIK, Sovet. vestnik oftal. **1**:222, 1932.

The author experimented with brilliant green on rabbits. One series of rabbits received instillations of 1 per cent brilliant green in 50 per cent alcohol and also instillations of an aqueous solution of the same dye. In the second series of rabbits the epithelium of the cornea was scraped off, and the denuded area was swabbed with the alcohol or aqueous solution of the dye. The alcoholic solution produced chemosis, epiphora and opacity of the cornea lasting about forty-eight hours, after which all symptoms abated. The aqueous solution produced a mild irritation of the ocular tissues.

The author then treated fifteen patients with corneal ulcers of various origin with an alcoholic solution of brilliant green. Complete recovery was observed in ten cases; in most of them the smear revealed a staphylococcic or a streptococcic

infection. In five cases, in which gram-positive diplococci were found in the smear, the effect of brilliant green was insignificant and the usual treatment had to be resorted to.

The author advises the use of brilliant green in staphylococcic or streptococcic infections of the cornea as a safe and quick therapeutic procedure.

SITCHEVSKA, New York. [ARCH. OPHTH.]

RETROBULBAR NEURITIS OF NASAL ORIGIN. A. FEIGENBAUM and M. SALZBERGER, Folia oto-laryng. orient. **1**:50 (Oct.) 1932.

The authors report twenty-four cases of retrobulbar neuritis. There were nineteen males and five females, and the disease occurred between 13 and 67 years of age, the average age being 33½. Seventeen cases were bilateral. Many of the cases occurred about four weeks after an epidemic of influenza. The visual field showed central or paracentral scotomas. The blindspot was enlarged in two instances. Examination of the fundus gave negative results in fifteen cases; there was pallor in seven, papillitis in one and a small hemorrhage, together with narrowed arteries, in the remaining case.

Nine patients had definite sinus disease, while roentgenograms gave positive findings for sinus infection in twelve patients. Multiple sclerosis could be ruled out in all cases.

Since conservative treatment seemed ineffective, the sphenoid and posterior ethmoid cells were opened in sixteen cases. Microscopic or macroscopic pathologic changes were found in all these cases. Eight of the patients who were operated on and three on whom operation was not performed were cured.

The authors feel that an inflammatory edema plus a direct toxic effect (on the papillomacular fibers) are the causal factors. The fact that most of these cases followed influenza is offered as a reason for considering that the etiology was nasal in this particular group. DUGGAN, New York. [ARCH. OPHTH.]

Diseases of the Ear, Nose and Throat

ACUTE ETHMOIDITIS. CHARLES GILMORE KERLEY, Arch. pediat. **50**:136 (Feb.) 1933.

A case of acute ethmoiditis with exophthalmos is presented, and the necessity of early diagnosis and treatment is stressed. WADDELL, JR., University, Va.

FURTHER STUDIES OF RHINOLALIA APERTA. DAVID L. POE, Arch. pediat. **50**: 147 (March) 1933.

Attention is called to the occasional occurrence of nasal speech following operations for the removal of tonsils and adenoids and to the persistence of the nasal quality of the voice following closure of a cleft palate. The mechanism of voice production and the disturbing influence of such operations to this mechanism are discussed in some detail. Present day methods of therapy looking toward the correction of nasal speech are discussed, particularly the use of electric current, stretching, massaging and speaking exercises. WADDELL, JR., University, Va.

TREATMENT OF TUBERCULOUS MASTOIDITIS IN CHILDREN. H. ROLLIN, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **133**:293 (Dec. 19) 1932.

In two cases of tuberculous mastoiditis in children, Rollin successfully employed roentgen irradiation in place of surgical intervention. The tuberculosis in both cases was limited to the middle ear, and the mastoid cells and other organs were not affected. There were no signs of foci of disintegration caused by a mixed infection. In each case three treatments resulted in the disappearance of the granulations in the auditory meatus as well as of the mastoid swelling. The secretion

stopped, and the tympanic membranes closed by cicatrization. The decreased hearing capacity returned almost to normal. There have been no recurrences in two years of observation, and no decrease in the hearing capacity has been observed as a result of the roentgen irradiation. The author recommends roentgen therapy as the method of choice in positively diagnosed tuberculous mastoiditis in children when it is not complicated by foci of disintegration due to a mixed infection.

EDITOR'S ABSTRACT. [ARCH. OTOLARYNG.]

TONSILLITIS AND WEATHER. G. EIGLER, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **134**:119 (Feb. 16) 1933.

Eigler says that a study of the cases of tonsillitis at his clinic during one year showed that the number of cases increased during the months of seasonal change, during weather changes, during periods of constant high atmospheric pressure associated with a drop in temperature and during periods of low atmospheric pressure. Strong wind and storms also seemed to favor the development of the condition. About one half of the cases of tonsillitis appeared after operations on the upper respiratory tract, especially after septum resection. In fifty-seven cases in which submucous septum resection was performed, bacteriologic examinations showed a decided change in the flora of the pharynx and of the tonsils several days after the operation; the number of hemolytic streptococci in the epipharynx and the tonsils was greatly increased, and they were usually found abundantly in pure culture in the nose. Not all patients with hemolytic streptococci who were operated on had tonsillitis, but hemolytic streptococci were found in all patients in whom postoperative tonsillitis developed. In almost all of ten cases in which the opsonic index of the blood was determined, the patients showed an increased opsonic index for their own streptococci several days after the tonsillitis receded. These facts indicate that streptococci are the etiologic agents in postoperative tonsillitis. The epithelial cells of the tonsils and pharynx appear to have a phagocytic function; those of the nose do not. Examination of the pharyngeal mucosa before, during and after inflammation showed, besides the normal condition, pharyngitis granularis, diffuse cellular inflammation, edema and inflammatory fibrous hyperplastic conditions. The author concludes that the atmospheric conditions, the hemolytic streptococci and the existing condition of the pharyngeal mucosa before intervention are the determining factors in postoperative tonsillitis.

EDITOR'S ABSTRACT. [ARCH. OTOLARYNG.]

ROENTGEN IRRADIATION OF TONSILS. K. TSCHIASSNY, Monatschr. f. Ohrenh. **66**:1444 (Dec.) 1932.

From a review of the literature Tschiassny concludes that the therapeutic value and the dangers of irradiation of the tonsils are not sufficiently well established to form a basis for indications for this therapy. He thinks that irradiation is not sufficiently innocuous as a conservative form of treatment, and that, as a treatment that is not innocuous, it is not rapid and reliable enough to be generally accepted. It is indicated chiefly in cases in which there are strong contraindications to surgical intervention. The author studied the morphologic effect of roentgen irradiation on the tonsils in a case in which one of the tonsils was removed by tonsillectomy at one sitting and the other was enucleated five weeks later after three roentgen irradiations. The patient was a child, aged 5 years; both tonsils before intervention exhibited hypertrophy of medium degree. On removal, the irradiated tonsil was found to be much larger than the other; the increase in size affected chiefly the segment hidden in the tonsillar fossa. The microscopic picture was characterized by a conspicuous enlargement of the germinal centers, which appeared loosened and heterogeneous in structure and exhibited much proliferation, giving the appearance of a neoplastic growth. This observation contradicts the experience of roentgenologists. A longer course of irradiation might have given a different result.

EDITOR'S ABSTRACT. [ARCH. OTOLARYNG.]

INDICATIONS FOR TONSILLECTOMY IN CHILDHOOD. A. I. CEMACH, Monatschr. f. Ohrenh. **66**:1453 (Dec.) 1932.

Cemach thinks that in many cases of adenoid syndrome the same therapeutic result can be accomplished by adenotomy alone as by the customary combined adenotomy and tonsillectomy. He reports that of 154 children on whom he performed adenotomy alone, although the tonsils exhibited more or less alteration, 68 per cent were completely cured of symptoms and 10 per cent were clinically improved to the extent that the parents did not wish further therapy; in only 21 per cent the symptoms were not influenced by adenotomy and tonsillectomy had to be performed. Correlating these results with the classification of the cases according to tonsillar symptoms, the author concludes that simple hypertrophy (cases of excessive size excepted) is not an indication for tonsillectomy. In recurring acute pharyngotonsillitis adenotomy alone should be performed at first. In chronic tonsillitis also it is permissible to essay adenotomy first, provided there are no general symptoms such as fever or signs of involvement of the heart, joints or kidneys.

EDITOR'S ABSTRACT. [ARCH. OTOLARYNG.]

EXPERIMENTAL HISTOLOGIC STUDIES OF THE TONSIL. R. WALDAPFEL, Ztschr. f. Hals-, Nasen- u. Ohrenh. **32**:400 (Feb. 12) 1932.

On the basis of an extensive experimental investigation on human beings and on animals, Waldapfel states that substances introduced into the mucosa of the inferior nasal concha reappear in the tonsils, where they can be demonstrated microscopically and to some extent chemically; substances introduced into other parts of the nasal mucosa are conveyed exclusively to the regional lymph nodes. Organic material reaches the tonsils in larger amounts than inorganic material, cellular material in still larger amounts and bacteria most abundantly. The coloring matter is distributed in varying amounts in different parts of the tonsil. The substances are conveyed from the nose into the tonsils by the efferent veins of the cavernous plexus of the inferior conchae which communicate with the veins of the pharynx, which in turn communicate with the tonsils. As the veins of both sides of the pharynx communicate with each other, the substances injected unilaterally into the concha appear in both tonsils. Following intravenous injections in other parts of the body, a small part of the injected material reaches the tonsils via the blood stream, but it is a much smaller proportion than that carried by the venous route from the cavernous plexuses of the nose. The substances which reach the tonsils are eliminated into the crypts through the epithelium, usually where it is reticulated, but also through intact portions. From six to twelve hours after intravenous injection the injected substance can be demonstrated in the crypts. Only small particles of bacterial size are eliminated. A part of the material entering the tonsil is conveyed to the regional lymph nodes. These experimental results confirm the opinion of those who attribute to the tonsillar tissue the function of ridding the blood stream of some of the foreign material which has entered it. They also attest that infection can spread from the nose to the tonsils not via the lymph channels, as is usually assumed, but by the venous route. This is possible because of the cavernous plexus of the nasal conchae which brings the venous blood so close to the exposed surface that infectious agents can enter it following the slightest injury of the protective covering.

EDITOR'S ABSTRACT. [ARCH. OTOLARYNG.]

PRIMARY TUBERCULOSIS OF THE TONSILS. H. HAMPERL and K. WALLIS, Ztschr. f. Hals-, Nasen- u. Ohrenh. **32**:480 (Feb. 12) 1933.

In connection with a case of primary tuberculosis of the tonsils, confirmed by necropsy, in a nursling aged 3 months, Hamperl and Wallis point out the difficulty of the diagnosis of this condition from the anatomicopathologic and especially the clinical standpoint. Cases in which an unquestionable diagnosis of primary tuber-

culosis of the tonsils can be made are extremely rare. In the case described, the mother of the child had active pulmonary tuberculosis, with many acid-fast bacilli in the sputum. It is probable that the transmission of the tubercle bacilli to the child occurred through the mother's practice of moistening the nipple of the nursing bottle with her own saliva.

EDITOR'S ABSTRACT. [ARCH. OTOLARYNG.]

Diseases of the Skin

SHOULD VASCULAR NEVI BE TREATED? EUGENE F. TRAUB, Arch. Pediat. **50**:272 (April) 1933.

In view of the obvious confusion existing in the minds of most physicians with regard to the proper treatment of patients with vascular nevi, the author has reviewed the literature on this subject, consulted several leading pediatricians and submitted a questionnaire to 117 members of the American Dermatological Association. From these questionnaires he arrives at the following summary and conclusions:

1. Hemangiomas and cavernous angiomas have been definitely observed to disappear spontaneously in a number of cases, the latter much more rarely, however, than the former.

2. This happens with such relative infrequency that it seems advisable to commence treatment during the first year of life, not delaying longer than the third year, and this only in the event that the lesion is stationary and does not increase in size.

3. True "port wine" marks rarely vanish, although the flat vascular nevi seen on the nape of the neck frequently disappear.

4. Large "port wine" marks are best left untreated, and only with great care should an attempt be made to eradicate even the smaller ones.

5. Hemangiomas and cavernous angiomas are in most instances best treated by the careful and conservative application of radium. In a few selected cases either surgical intervention or carbon dioxide snow may be the treatment of choice.

WADDELL, JR., University, Va.

HERPES ZOSTER AND DISSEMINATED VESICLES. ALFRED E. FISCHER, J. Pediat. **2**:301 (March) 1933.

The literature concerning the possible relationship between varicella and herpes zoster is reviewed. One case is reported in which typical herpes zoster appeared and was followed one day later by a generalized vesicular eruption resembling varicella. The author is of the opinion that herpes simplex, varicella and herpes zoster are due to separate viruses that are to some extent related.

LEMASTER, Evanston, Ill.

ACRODYNIA. KENNETH D. BLACKFAN and CHARLES F. MCKHANN, J. Pediat. **3**:45 (July) 1933.

The forty-four cases of acrodynia seen at the Harvard Clinic during the past nine years are discussed from the standpoint of symptoms, physical findings, laboratory data and postmortem observations. The authors favor the view that the manifestations of acrodynia are dependent on a diffuse disorder of the central nervous system with overstimulation of both the sympathetic and parasympathetic divisions.

LEMASTER, Evanston, Ill.

SERUM PROTEINS AND LIPOIDS IN THE ECZEMA OF INFANTS AND CHILDREN. HAROLD K. FABER AND DOROTHY B. ROBERTS, J. Pediat. **3**:78 (July) 1933.

The serum protein of infants with eczema was found to show deviations from the normal very frequently. A high content of albumin, a low content of globulin and a high albumin-globulin ratio occurred more frequently in patients with eczema

than in normal children. In half the patients with eczema the level of the serum cholesterol was more than 200 mg. per hundred cubic centimeters, but in a few instances the cholesterol content was very low. The results indicate that in eczema there is often instability in the protein and cholesterol metabolism, which is probably to be regarded as a secondary or subsidiary manifestation of the general disturbance. No difference in the phospholipids of the serum was detected in the patients with eczema as compared with the controls.

LEMASTER, Evanston, Ill.

NAPKIN RASH IN BABIES. ERIC PRITCHARD, M. J. & Rec. **137**:408 (May 17) 1933.

One is reminded that the rash found so often over the buttocks in small babies may not be what is usually called napkin rash. The inflammation may be due to hypersensitiveness of the skin, such as occurs in eczema, to high degrees of acidity in the urine or to urticaria. In the latter the rash is at first discrete; it may become papular and then ulcerate; later the areas may coalesce with the formation of serpiginous outlines. Cases of this type are often incorrectly ascribed to syphilis. Genuine napkin rash is due to irritation of the skin with ammonia, perhaps in the diaper. The ammonia salts are present only in strongly acid urine, and when they are neutralized by contact with the sodium in the diaper the ammonia is liberated. The author's treatment for this condition is to give the infant large doses of sodium bicarbonate or some other alkali. Local treatment consists in exposing the parts to the air as much as possible and using a good talcum powder, with or without the application of castor oil ointment.

WILLIAMSON, New Orleans.

ALOPECIA ASSOCIATED WITH HYPOTHYROIDISM IN A CHILD. I. NEWTON KUGELMASS, New York State J. Med. **32**:1371 (Dec. 1) 1932.

A boy, 9 years of age, had been under treatment in various dermatologic clinics for two years without improvement.

A diagnosis of hypothyroidism was made by a study of the basal metabolism, and the boy was given treatment with a combination of thyroid and pituitary. A raw base-forming diet of raw milk, eggs, fruits, vegetables and cod liver oil was also given. Iron and copper internally and a scalp massage with cod liver oil completed the treatment. A complete recovery occurred in six months.

AIKMAN, Rochester, N. Y.

CONGENITAL ECTODERMAL DEFECT (GUILFORD'S DISEASE). H. HAXTHAUSEN, Hospitalstid. **75**:60 (Dec. 15) 1932.

The patient was a servant boy of 17, who from birth had manifested a peculiar condition of the skin, its adnexa and the tendons. There was no family history of a similar condition. The patient had been bald up to 7 years, when a thin growth of hair began on the scalp but remained short and thin. He had only five teeth, and these fell out, so that at 14 he had to have a complete prosthesis. From his ninth year he had a pronounced thickening of the skin of the palms and soles. During the year previous to presentation, moreover, there was a tendency to reddening and irritation of the skin of his face when subjected to light or cold. The hairs were light, dry, thin and short. His eyebrows were scanty. The axillary and pubic hair was absent. The skin of his entire body was very thin and white like that of a child, with patches of marked cutis marmorata on the extremities. His face was deeply congested by large telangiectases, and the areas on the nose and cheeks which were especially exposed to light also displayed atrophic changes. The nose was small and pointed. On his palms and soles there was a diffuse hyperkeratosis like that on the face, due to hereditary palmar and plantar keratosis. Neurologic and physical examination showed normal conditions. The basal

metabolism test gave normal values. The height was 156 cm.; the weight, 50 Kg. The blood pressure was 120 systolic and 80 diastolic. The Wassermann reaction was negative. The spinal fluid was normal. Roentgen examination of the sella turcica showed that it was of normal proportions.

These features suggest the malformations first described by the American dentist Guilford, of which several examples have been reported, particularly in the American literature. Among the symptoms thus far described, keratoses of the palms and soles have not been recorded in patients with congenital ectodermal defects.

VINTON, Brooklyn.

TREATMENT OF IMPETIGO. J. L. NEWMAN, Brit. M. J. **1**:823 (May 13) 1933.

This article is an outline of the author's methods of treating impetigo, with a discussion of three types of treatment.

ROYSTER, University, Va.

THE SODIUM CHLORIDE METABOLISM IN PATIENTS SUFFERING FROM EPIDERMOLYSIS BULLOSA DYSTROPHICA. M. K. POLANO, Nederl. tijdschr. v. geneesk. **76**:4207 (Sept. 3) 1932.

A diminution in the renal excretion of sodium chloride is described in two patients, aged 14 and 17, suffering from epidermolysis bullosa dystrophica. This diminution should be regarded as a symptom of the disease to be found in generalized cases. No influence on the course of the sickness could be found by the administration of a diet containing great quantities of sodium chloride or of one containing no sodium chloride.

VAN CREVELD, Amsterdam, The Netherlands.

Surgery and Orthopedics

LATE RESULTS OF SEPARATION OF AN EPIPHYSIS. JAY IRELAND, Ann. Surg. **97**:189 (Feb.) 1933.

Twenty-six patients with separation of an epiphysis were seen at the Children's Memorial Hospital from 1911 to 1931. Of these, only eighteen could be traced for later examination; they are the basis of this article.

The eighteen patients had nineteen epiphyseal separations. Sixteen of the separations were due to trauma and three to scurvy. The two patients (three separations) with scurvy were treated by rest, antiscorbutic food and medication. Eleven of those with separation due to trauma were treated by closed reduction, and the other five by open operation.

In summarizing the results, the author advises against open reduction if possible. He also states that the outlook in regard to deformity and function seems to differ in the various epiphyses.

BANTIN, Omaha.

OPERATIVE ARRESTMENT OF LONGITUDINAL GROWTH OF BONES IN THE TREATMENT OF DEFORMITIES. D. B. PHEMISTER, J. Bone & Joint Surg. **15**:1 (Jan.) 1933.

The author discusses the causation of, and the operative treatment and the technic of his operation for, the correction of deformities of the bones. In conclusion, the following statements are made: "1. Selected cases of inequality of length of limbs during the growing period may be treated by epiphyseodiaphyseal fusion, arresting growth in the longer limb, and thereby approximating or equalizing limb lengths at the end of the growth period. 2. Angular deformities of the wrist or ankle, the result of disproportion in length of the two bones of the forearm or leg, may be improved by either unilateral or complete arrest of growth in the longer bone at the appropriate age."

RYAN, Vancouver, Canada.

OPERATIVE FIXATION OF TUBERCULOUS HIPS IN CHILDREN. J. C. WILSON, J. Bone & Joint Surg. **15**:22, 1933. A REPORT OF SEVENTEEN CASES OF TUBERCULOSIS OF HIP FUSED BY THE WILSON METHOD. LOUIS ALPERT, ibid., p. 48. COMBINED INTRA-ARTICULAR AND EXTRA-ARTICULAR ARTHRODESIS FOR TUBERCULOSIS OF HIP JOINT. M. S. HENDERSON, ibid., p. 51.

The consensus of these three authors is that operative fusion of tuberculous hip joints should be done as soon as possible, both from the standpoint of the patient's welfare and from that of expense. The operation does not add any handicap, since the hip is stiff before operation; the handicap is actually lessened, since the operation alters a painful stiff hip into a painless one. RYAN, Vancouver, Canada.

ACUTE INTUSSUSCEPTION. CHARLES W. MAYO, Nebraska M. J. **18**:121 (April) 1933.

The most common intussusception found in children is the ileocolic type. Eighty per cent of the cases of intussusception affect children less than 2 years of age, and 50 per cent affect children between 5 and 9 months of age. The condition is twice as frequent among boys as among girls. In the surgical treatment the two chief factors which determine what is to be done are the duration of the symptoms and the extent of the intussusception. Reduction is usually possible within twenty-four hours. The defense mechanisms in the body attempt to arrest progress and to fix the intussuscepted bowel so as to prevent perforation. Edema, swelling and fibrous adhesions cut off the blood supply and prepare the intussuscepted loop for spontaneous elimination. Undue manipulations and extensive handling of the intestines must be avoided. After difficult reduction, when there is a question as to the viability of the intestine, it is better to wrap it in omentum or fold it on its own mesentery than to resect it. If resection seems advisable, it is better to extraperitonize the involved loop and perform resection later. The average mortality from immediate resection is about 85 per cent. HAMILTON, Omaha.

MECKEL'S DIVERTICULITIS IN AN INFANT. RALPH R. MOOLTEN, New York State J. Med. **32**:1070 (Sept. 15) 1932.

A case of acute diverticulitis with perforation and a peridiverticular abscess is reported. General peritonitis did not develop. The patient, aged 7 months, died of intercurrent infections twenty-six days after operation.

AIKMAN, Rochester, N. Y.

TANNIC ACID TREATMENT OF BURNS. D. MARTIN, JR., South. M. J. **26**:321 (April) 1933.

An aqueous solution of from 2.5 to 5 per cent tannic acid is applied to the surface of the burn by means of an ordinary atomizer every thirty minutes until a good tannate is formed, which usually requires from six to eighteen hours.

In first degree burns, and in some small second degree burns, the coagulum begins to loosen in from eight to twelve days, leaving a dry layer of epithelium. In deeper burns, the tannate must be removed, which is usually done by softening the edges with gauze to which dichloramine has been applied and wet dressings of saline solution. The sooner the coagulum is removed at this stage, the earlier the grafting can be done.

After all the coagulum has come off, the raw surface is prepared for grafting by the application of saline solution dressings.

The mortality of children has been greatly reduced by treatment with tannic acid. There are fewer complications; there is less scar formation, and the treatment lessens the pain during the first few hours and prevents loss of vital body fluids through the wounded surface. The necessity for frequent and painful dressing is removed. SCHLUTZ, Chicago.

RECONSTRUCTIVE OESOPHAGOPLASTY: WITH NOTES OF A SUCCESSFUL CASE. H. H. SAMPSON, Brit. J. Surg. **20**:447 (Jan.) 1933.

Reconstructive esophagoplasty is desirable in cases of stricture of the esophagus. Such strictures are usually the result of the swallowing of a corrosive fluid. They occur chiefly in the lower end of the esophagus, where movement is retarded or arrested. Unless the stricture is truly impermeable, it is probable that gradual dilatation may be successful.

In a case of complete occlusion, gastrostomy had to be performed as a life-saving measure. Many attempts have been made to reestablish continuity between the pharynx and the stomach. In 1904, connecting the stomach with a skin tube was first suggested. In the operation described by Sampson, this principle has been made use of, and an isolated piece of the jejunum was used as the connecting link between the stomach and the skin tube. The operation is performed in three stages: First, the skin tube is formed; second, the upper end of the esophagus is attached to the skin tube, and third, a piece is taken from the jejunum and inserted between the stomach and the skin tube. A case is cited in which the results obtained were satisfactory.

SUMMERFELDT, Toronto, Canada.

THE TREATMENT OF BURNS AND SCALDS. PHILIP H. MITCHINER, Lancet **1**:233 (Feb. 4) 1933.

Hippocrates, in 435 B.C., advocated the treatment of burns by a mixture of beeswax, myrrh and certain balsams of an antiseptic nature, but a far older treatment dating back five thousand years is still rather universally used in China, the country in which it originated—the treatment of burns by tannic acid in the form of tea.

The author describes in detail the technic of the compress method. He emphasizes the importance of thorough cleansing at the start by removal of all dead and charred tissues and gentle washing of the whole area with soap and water applied with a sterile swab. The patient is rendered insensible to pain by the administration of large doses of opium rather than by a general anesthetic. A gauze compress soaked in a stock solution of 2 per cent tannic acid and 1:2,000 solution of corrosive mercuric chloride is applied closely and evenly over the entire burned area. This dressing should be left in position and should be untouched for at least a fortnight in the case of small burns and scalds and for three weeks in the case of large burns. Fever and toxemia are the only indications calling for the removal of the dressings before the end of these periods. In certain areas, such as the perineum, the groin, the axillae, the neck and the face, application by spraying gives better results.

With the old method of treatment by bathing and greasing the average mortality was 39.6 per cent for burns and 18.8 per cent for scalds; in the last five years treatment with picric acid has reduced the mortality to 15.5 per cent for burns and 7.5 per cent for scalds, and treatment with tannic acid has reduced the mortality to 4 per cent for burns and 1.7 per cent for scalds.

LANGMANN, New York.

TRAUMATIC HEMOPNEUMOTHORAX TREATED BY CONTINUOUS SUCTION DRAINAGE. H. V. MORLOCH, Proc. Roy. Soc. Med. **26**:270 (Jan.) 1933.

A boy of 9 years had been knocked down by a horse and cart and a wheel had passed over him. He was restless and collapsed, and was suffering from generalized abdominal tenderness. He was watched carefully, and on account of an increasing pulse rate he was thought to have intraperitoneal hemorrhage. The abdomen was explored, and no ruptured viscus or bleeding point was found. The next morning he was semicomatose. The pulse rate was 156, and the respiratory rate, 45. The patient was markedly cyanosed, with suffusion of the face and neck. The left side of the chest was prominent over the upper region; the percussion

note was hyperresonant over the lower portion and behind it was impaired. Breath sounds were absent over the lower part of the lung anteriorly; the heart was displaced to the right anterior axillary line. A diagnosis of left hemopneumothorax was made. A trocar and cannula were inserted into the thorax and connected to a manometer; the intrapleural pressure was +15 and +20. Thirty ounces (900 cc.) of blood and an unknown quantity of air were aspirated over a course of thirty-six hours, after which the cannula was removed, and the child steadily improved.

WILLIAMSON, New Orleans.

DIFFICULT VERTEBRAL ROENTGENOGRAPHIC DIAGNOSIS. J. CALVÉ and M. GALLAND, Scalpel **85**:1233 (Oct. 1) 1932.

The authors first consider cases of compression of the vertebral disk not attributable to Pott's disease. These are of congenital origin, accompany advanced sacralization or are seen in chronic spinal rheumatism. Next the authors discuss the dissimilar group of flattened vertebrae, some forms of which may also be mistaken for Pott's disease. They propose a classification based on that of Polgar: (1) vertebra plata congenita simplex (microspondylitis), (2) vertebra plata congenita larga (corresponding to Putti's platyspondylitis), (3) vertebra plata chondrodystrophica, (4) vertebra plata et plana osteonecrotica (Calvé's disease), (5) vertebra plata osteoporotica and (6) vertebra plata traumatica (Kümmel's disease).

VINTON, Brooklyn.

INFANTILE VULVOVAGINITIS. M. CARBONE, Prat. pediat. **10**:455 (Oct.) 1932.

Dr. Carbone reviews briefly the subject of infantile vulvovaginitis, stressing particularly gonorrheal infection, but he makes no original contribution. He is of the opinion that chronic vulvovaginitis in childhood may result in endometritis, salpingitis and even sterility. With the exception of irrigations with fresh ox bile (10 per cent in a physiologic solution of sodium chloride), the treatments which he suggests may be found in any standard textbook.

DOOLEY, Kent, Conn.

BLOODLESS TREATMENT OF WRYNECK IN CHILDHOOD. JOSEF KELLEMAN, Monatschr. f. Kinderh. **57**:7 (Feb.) 1933.

The author reviews the various theories of the etiology of wryneck and concludes that none is convincing. He then reviews the different surgical procedures used in the treatment of this condition and reports his own experience with the injection of solution of pepsin and Pregl's solution (the solution resulting from the action of iodine on sodium carbonate solution) into the scar tissue of the muscle. He treated thirty-two patients, five immediately following birth, eleven between 1 and 4 weeks of age, fourteen between 1 and 3 months of age and two between 4 and 7 months of age. Nineteen of the patients were girls, and thirteen were boys. The solution that he used is made after the method of Payr and Rosenbaum. The treatment is given twice weekly, from 0.5 to 1 cc. being injected directly into the muscle. Marked improvement follows in most cases in from three to six weeks. Kelleman believes that the results achieved by this method are far superior to those obtained with any surgical methods now in use.

GERSTLEY, Chicago.

Miscellaneous

CLINICAL AND EXPERIMENTAL STUDIES ON THE EFFECT OF EPHEDRINE IN CHILDHOOD. CURZIO BONZANIGO, Arch. f. Kinderh. **94**:15 (July 17) 1931.

The effect of ephedrine on 46 well infants and children was investigated. Children between 2 and 6 years of age reacted to the ephedrine with increased blood pressure and often with sweating, and in almost all cases about forty-five minutes after the drug was given fell asleep for about an hour. The sleep-

producing effect of ephedrine occurred less often in children under 2 years and over 6 years of age. In infants a large dose of ephedrine was required to raise the blood pressure. Administration of atropine with ephedrine augmented the rise in blood pressure and increased the tendency to sleep. The suggested doses of ephedrine to be used at various ages are as follows: 25 mg. subcutaneously for children from 7 to 13 years old; 20 mg. for those from 2 to 6 years old, and 15 mg. for infants from 3 months to 2 years old.

LeMaster, Evanston, Ill.

A Pneumothorax Apparatus with Simple Manipulation For Children. László Dobszay and István Salamon, Arch. f. Kinderh. **94**:202 (Sept. 11) 1931.

The authors describe a pneumothorax apparatus which they claim is effective, safe, inexpensive and easy to manipulate. Diagrams and instructions for its use are also presented.

LeMaster, Evanston, Ill.

Graphic Portrayal of Endogenous Disturbances in Growth. Felix Schleissner, Arch. f. Kinderh. **95**:269 (Feb. 5) 1932.

The author has worked out a method of linear representation showing variations from the normal. Starting with a base line which is normal for a child of a given age, the graph goes up or down in proportion to how much the child is above or below average height. The line straightens out and then shifts again to represent the weight in comparison with the average normal age and height. The series in this study represent gigantism, dwarfism, cases of precocious puberty, cases of hypoplasia, hypothyreosis and cretinism.

Leslie, Chicago.

Schönlein as Pediatrician. W. Stoelzner, Arch. f. Kinderh. **95**:289 (Feb. 5) 1932.

Schönlein was born in 1793 and died in 1864. He was one of the most famous doctors of that time and was responsible for inspiring many well known men in the fields of clinical and laboratory study; Virchow and Traube are numbered among these. Although his attempt to fit diseases into a system of classification such as that which Linné had employed successfully for plants and animals seems of no value, he did, nevertheless, accomplish a great deal in clearing the way for the advances in medical knowledge of the late nineteenth and early twentieth centuries. In pediatric literature his name has been incorrectly associated with that of Henoch in relation to abdominal purpura. His particular contribution in the field of pediatrics was the description of rheumatic purpura. He did not believe in rushing into print and published only two articles in his lifetime. The handbook which bears his name was prepared by one of his pupils without his consent.

Leslie, Chicago.

The Disappearance of the Summer Peak in the Mortality of Infants. Elfriede Busch, Gesundhfürs. f. d. Kindesalt. **7**:249 (Oct.) 1932.

Benjamin Rush, the well known contemporary and friend of Franklin, is the first man who described the summer peak in the mortality of infants. Rush realized that the cause was to be found in the poor home conditions and prescribed fresh air during the morning and evening or removal to the country. In Germany, this peak did not become evident until the second half of the nineteenth century, and its appearance is to be ascribed to the development of industry and large cities. From about 1890 on, the summer mortality gradually began to sink. This the author ascribes to the development of social service for infants. In the last twenty-five years the summer peak has decreased until now one must speak of a winter peak and a summer trough.

The author has examined the mortality lists of several large cities in Germany and comes to the following conclusions:

The higher the general infant mortality in any district is, the more frequently one will find a summer peak and the higher it will be. Furthermore, it takes a longer period of time for it to disappear from the mortality lists. For Germany the summer peak is apparently to be ascribed to local conditions; it is no more a national problem. Climatic conditions, density of population, birth rate, social status of the population, are all or in part factors in the increase or decrease of summer mortality. The improvement in infant feeding and in the general care of the child, the increased breast feeding and the careful control of the child through social service have undoubtedly been the chief factors in decreasing the summer mortality.

REICHLE, Cleveland.

PETROLEUM AND BENZINE POISONING. STURE A. SIWE, Monatschr. f. Kinderh. **55**:146, 1932.

The author reports one case of benzine and one of petroleum poisoning. In each case the child drank a small amount. The symptoms were identical, the onset being associated with vomiting and diarrhea. Then followed symptoms of involvement of the nervous system such as coma and convulsions. The most constant symptoms were a rapid heart rate and rapid respiration with attacks of apnea. Slight fever developed. In both cases there was recovery with no specific treatment.

From these cases and from a review of the literature the writer warns that attacks of apnea and convulsions may occur from thirty-two to forty-four hours after the taking of the poison, with no intervening alarming symptoms.

GERSTLEY, Chicago.

EDUCATION OF CHILDREN AND PEDIATRICS. BIOLOGIC FOUNDATIONS OF EDUCATION. F. HAMBURGER, Wien. klin. Wchnschr. **44**:725 (June 5) 1931.

The education of children is closely connected with the field of prophylactic pediatrics, as many diseases can be prevented through education. The author discusses the biologic foundations underlying the principles of education. Almost every child possesses several fundamental qualities or instincts, such as imitative and social instincts. By the direction of these instincts with the use of educational devices, the education and rearing of children can proceed almost automatically. This point he considers very important. He compares it to the automatism of food intake, which functions smoothly when subject to natural hunger or appetite and when no so-called rational, but in reality nonrational, speculations are practiced.

ABT, Chicago.

GENERAL HEALTH EXAMINATION OF PUPILS IN FIRST GRADE OF PUBLIC SCHOOLS IN DEBRECEN. E. NEUBER, Wien. klin. Wchnschr. **45**:98 (Jan. 22) 1932.

This report deals with a health examination of 1,909 pupils of the first grade of the public schools, with special consideration of acute and chronic infectious diseases (syphilis, tuberculosis, scabies and infections due to fungi, intestinal worms and other parasites) and also with consideration of other diseases of the skin and internal organs, of the teeth, of anthropometric measurements, of roentgenologic findings, of housing conditions and of the condition of health of the relatives.

The investigation was begun in October, 1914, in the clinics of the University of Debrecen, in two large, specially equipped halls, with the cooperation of fifteen physicians, one medical social worker, one typist and four nurses. The presentation and the scope of this investigation exceeded anything attempted so far in Europe or in the United States; the purpose also was different from that of similar undertakings.

The main purpose was preventive hygiene: to prevent the infection and even the possibility of infection of healthy children by prohibiting the school attendance of children suffering from severe infectious diseases (syphilis, tuberculosis, etc.). It was intended to locate the diseased parents with the aid of the medical social worker, and refer them to the dermatologic clinic, which as a rule they were willing to visit. Methods of determining the presence of syphilis and tuberculosis and the influence of housing conditions on tuberculosis are reported. Tuberculosis was found to be more frequent in children living in basement flats. Of 659 children whose feces were examined, 43.5 per cent were found to be suffering from worm infection. In many of these children an erroneous diagnosis of anemia and nervousness was made prior to the examination.

ABT, Chicago.

AN OBSERVATION ON STANDARD FORMULAS OF BODY WEIGHT IN JAPANESE CHILDREN. N. ASAI, J. Pediat. (Tokyo), Nov. 20, 1932, no. 390, p. 2086.

The author proposes the following three formulas according to the age groups as fairly satisfactory means of calculating the body weight of Japanese children:

I. For infants under 2 years: $\frac{(30-M)\ (3+M)}{30}$ in Kg. (M in this equation is the age of the infant in months.)

II. From 2 to 9 years: $1.5 \times J + 8$ in Kg. (J represents the age of the child in years.)

III. From 10 to 14 years: $3 \times J - 6$ in Kg.

KATO, Chicago.

HYPERSENSITIVENESS TO VARIOUS SUBSTANCES IN DIFFERENT MEMBERS OF A SINGLE FAMILY. OLOF BILLQVIST, Acta pædiat. **13**:28 (June 6) 1932.

Both parents and all of their four children gave positive cutaneous reactions to fish. In addition, there were scattered positive reactions to epidermal proteins, lactalbumin, timothy and beans, corresponding to clinical manifestations of hay fever, asthma, urticaria and acute digestive disorders.

MCINTOSH, New York.

PEDIATRICS AND ORTHOPEDICS. P. HAGLUND, Acta pædiat. **13**:144 (June 6) 1932.

The author pleads for closer cooperation between the orthopedist and the pediatrician.

MCINTOSH, New York.

RETRENCHMENT IN MEDICAL CARE. A. KELLER, Acta pædiat. **13**:271 (June 6) 1932.

During prosperous times costly institutions for medical care were created, the upkeep of which has become an almost intolerable burden. Retrenchment is necessary.

Behavior problems are on the increase, and it is the duty of pediatricians to take an active and whole-hearted part in their cure and, more essentially, in their prevention.

MCINTOSH, New York.

BREATHING EXERCISES FOR CHILDREN. I. SAMZELIUS-LEJDSTRÖM, Acta pædiat. **13**:307 (June 6) 1932.

Few will agree with the author's vigorous plea that children should from an early age be made conscious of respiration. No evidence is given for her contention that deep breathing wards off colds and tuberculosis, or that chronic unilateral nasal obstruction regularly produces homolateral thoracic deformity. Her final advice is never to breathe any but healthful atmospheric air.

MCINTOSH, New York.

Society Transactions

AMERICAN ACADEMY OF PEDIATRICS AND CENTRAL STATES PEDIATRIC SOCIETY

Joint Meeting, Chicago, Sept. 22 and 23, 1933

Friday Morning, Sept. 22, 1933

JOSEPH BRENNEMAN, M.D., *Chairman*

URINARY OBSTRUCTION IN CHILDREN. DR. H. L. KRETSCHMER, Chicago.

Obstruction in the urinary tract or intestinal tract should be recognized early, because such an obstruction soon leads to stasis and may result in renal atrophy and the death of the patient. In the early stage there is nothing by which such a lesion can be recognized, but sooner or later infection results and pus appears in the urine. It is therefore important to determine the cause of the pyuria. If the intestinal tract is investigated the conception of so-called pyelitis in infancy will often change on the discovery that many such infections are superimposed on an obstruction. Among the intra-urethral lesions in children, stricture is rare; next in frequency are valves or bars at the orifice. While, in the main, these lesions are uncommon, I believe that if study is directed toward the urinary tract, more and more will be found. There may be a combination of valves and bars. The obstruction may occur at the junction of the pelvis with the ureter. A stone may be there, but seldom, or the condition may be due to a disease of the central nervous system. The diagnosis is simple if one bears in mind the possibility of an obstructing lesion being responsible for the symptoms or the persistence of pyuria. One should determine why the pyuria persists, and that can be done by means of intravenous pyelography. Many patients present a history of tumor or of dribbling, which should afford a clue to the underlying pathologic process. For treatment of an obstruction, dilatation may suffice, or possibly a plastic operation.

The problem resolves itself into the recognition of the urologic condition, determining the cause of obstruction and instituting the proper treatment.

SACROCOCCYGEAL CHORDOMAS AND CYSTIC TUMORS OF THE ABDOMEN IN CHILDREN. DR. ALBERT H. MONTGOMERY, Chicago.

This article was published in full in the December, 1933, issue of the AMERICAN JOURNAL OF DISEASES OF CHILDREN, p. 1263.

SUMMARY OF THE ORTHOPEDIC PRESENTATION. DR. FREMONT A. CHANDLER, Chicago.

Ordinary torticollis, first noted at the time of birth or shortly thereafter, has usually been considered a hematoma developing in the sternocleidomastoid muscle. In the case presented, a tumor was explored when the patient was about 6 weeks of age and was found to consist not of organizing hematoma but of excessive fibrous reaction, fibrous tissue replacing the normal muscle fibers. This is consistent with trauma to the sternocleidomastoid muscle during or before birth, and the attempt at repair, simulating, somewhat, the excessive callus formation found in the new-born. Such a tumor is not present at the time of birth, but is noted usually after about a week or ten days. It gradually increases in size,

reaching a maximum when the child is about 3 or 4 weeks of age, after which it gradually diminishes, either entirely absorbing or leaving the sternocleidomastoid muscle as a firm fibrous band. This band prevents the normal rotation of the head and the subsequent development of asymmetry of the face and skull. In no patient operated on was a hematoma found. Slides of the pathologic tissue removed when the patient was 5 weeks of age were demonstrated. This case showed complete absorption of the mass following surgical intervention.

The surgical procedure employed in the usual case of torticollis consists of the release of the insertion of the sternocleidomastoid muscle at the medial end of the clavicle and at the sternum. In the acquired case, torticollis does not date back to the time of birth and is usually the result of some low grade irritative process developing in the side of the neck or in the articulation of the cervical spine.

Cases of Thomsen's disease, pseudohypertrophic muscular dystrophy and tuberculosis of the knee, hip and spine and cases of knee fusion, hip fusion and spine fusion were also presented. Two cases of flatfoot in which the patients were treated by operation were demonstrated.

REPORT OF CASES. DR. JOSEPH BRENNEMANN, Chicago.

CASE 1.—I saw this girl first in the outpatient department and was told that she had a tumor of the lower part of the abdomen. She had a large, well extended bladder with a projection on one side. She was admitted to the hospital with a history of cramps for three days two weeks before admission. Since that time the patient had been able to sit on one side or the other, but when she sat in the middle she had pain in the lower part of the abdomen. We made a careful examination and found that the vagina had no outlet, and decided on surgical intervention. Dr. Montgomery removed about 1½ quarts (1,400 cc.) of blood from the vagina; this child had menstruated with no outlet to the vagina.

CASE 2.—This child was admitted to the hospital when 9 months of age, with a history of sickness for two months, with convulsions and cyanosis of the hands and feet. In addition, there was evidence of marked headache, as she held her hands to the head constantly. With this was definite hydrocephalus; the sutures and fontanels were open. The symptoms did not look quite typical, because the head was globular. Subdural punctures yielded 8,000 cells and 3,200 cells. On aspiration several times 10 or 12 ounces (300 to 360 cc.) of pure pus was withdrawn; it contained a gram-positive bacillus. Dr. Montgomery made an incision on each side of the head. There was a great discharge of pus, and for a while there was threat of hemiplegia, with some nystagmus. The patient has made an apparent complete recovery. The results are usually entirely unfavorable. The condition is not primarily an infection, but usually an infection superimposed on pachymeningitis.

CASE 3.—The third child was admitted to the hospital when 13 months old, with a distended abdomen. My associates and I were not sure that the condition was peritonitis, for there was not much fever, so we thought it better to await developments before intervening. The swelling perforated at the umbilicus, and there were some pneumococci and other organisms in the discharge. Such infections usually should be let alone until they wall off. If the peritonitis is secondary to appendicitis there should be surgical intervention; if not, if it is the so-called primary peritonitis, it is pneumococcic peritonitis. The outlook is ordinarily quite good. One can usually assume, if there is a high blood count, that it is not secondary to appendicitis. In this case there was a discharge from the umbilicus for some time.

TETANUS DURING THE LAST THREE MONTHS. DR. JOSEPH BRENNEMANN, Chicago.

During the last three months the number of cases of tetanus has been much above the average. The first patient was 8 or 9 years of age, and had ordinary tetanus. He was treated by all approaches, including spinal treatment. We did not think it a particularly serious case, but the patient suddenly died.

The second child had tetanus for five days before admission to the hospital. There was a scar on one knee that showed no symptoms. Eighty thousand units of antitoxin was injected intramuscularly. Two weeks after admission she was entirely well, and she remained so for nineteen days after the administration of antitoxin, when she had a new attack, and went through the whole course of infection again. Another 30,000 units was injected, and the patient recovered. The immunity for tetanus antitoxin lasts only one or two weeks, which accounts for the second attack. Then we removed the scar on the knee, and from that time the patient was all right. Avertin was satisfactory in keeping her quiet. She would sleep for hours under it, and it completely controlled her. She is now all right.

We had two other cases. I was asked to examine a child who could not open his mouth and had distress in swallowing. I had not seen such a case before, but decided that the patient had tetanus. He was given a large amount of antitoxin, and the condition was improving, when suddenly he died. A few weeks later the fourth child came in. She could not open her mouth, but aside from that there were no generalized symptoms. She was given 60,000 units of antitoxin intramuscularly and 10,000 units intravenously.

One difficulty in prognosis is the variableness of tetanus. One never knows what the outcome will be. It is difficult to say what effect the treatment has. Attention should be paid to the symptom of the patient not being able to open the mouth and to this facial appearance, the risus sardonicus. The focus of infection should be removed as thoroughly as possible, and then the antitoxin should be given. I do not think that intraspinal injection is always indicated; in fact, I think that the results are better if that method is not used. In the patients who recovered, it was not used, and in the others, who died, it was.

CONGENITAL DEFORMITIES. DR. E. T. MCENERY, Chicago.

This group of children with congenital deformities is presented because it depicts an unusual combination of anomalies. These 6 children represent a group of 225 children who have come to the hospital during the past seven years with harelip or cleft palate. Cleft palate occurs approximately once in every thousand births; so this group represents more than 225,000 births. In a review of the literature, I find no mention of this type of condition; and in discussing the subject with oral surgeons and on showing them these pictures, I discovered that they had never seen such cases.

These anomalies involve the morphology of the face. The defect for the most part is in the formation of the maxillary bones and the zygomatic arch, together with the temporal bones. The defect involves the soft tissues as well as the bone structure, so that there is a deformity of the eyes, ears, cheeks, lips and palate.

PULMONARY ACTINOMYCOSIS. DR. E. T. MCENERY, Chicago.

Actinomycosis in man is primarily a disease of early adult life. Its occurrence in children is infrequent. Sanford, in 1922, reported forty cases, of which only 5.5 per cent were pulmonary. Edwards, in 1932, said that the thorax was involved in 21 per cent of the cases of actinomycosis in children. The duration of the disease is usually from two to three years. The prognosis is always fatal.

CASE 1.—A white boy, aged 3½ years, was brought to the hospital because of loss of weight and poor appetite. Advice was given as to feeding and rest. When next seen six months later the patient had a harsh nonproductive cough, which had been present for the past three months. He had lost weight and was subject to severe sweats. He had never been out of the city, nor had he come in contact with cattle or grains.

Physical examination revealed a white boy poorly nourished and acutely ill. The right lung was flat to percussion from top to bottom; the heart was not displaced to the left. Bronchial breathing was marked all over this area, but no râles were present. A tentative diagnosis was made of pleurisy with effusion on a tuberculous basis. The tuberculin tests were negative. Roentgenograms revealed a diffuse shadow obliterating all pulmonary markings on the right side. The chest was aspirated, but no fluid was obtained. A short time after admission a mass developed on the right side of the sternum. This mass was aspirated, and typical sulphur granules of actinomycosis were found on the smear. The course was progressively downward, despite treatment with roentgen rays, thymol, moderate doses of potassium iodide and surgical intervention. The patient died fourteen months after admission to the hospital.

Postmortem examination revealed extensive actinomycosis of the right pleural cavity, with a spreading to the ligaments covering the vertebrae. The bodies of the vertebrae and disks were not involved. Extensive metastases to the brain were also present.

CASE 2.—A white boy of 8 years was admitted to the hospital because of a swelling on the left side of the chest for the past month, accompanied by a nonproductive cough. This boy had always lived in the city and did not come in contact with cattle. Physical examination revealed a fairly well nourished white boy, not acutely ill, but with a large swelling on the anterior wall of the chest, along the left sternal margin. Resonance was impaired over the upper two thirds of the left lung, with suppression of breath sounds over the same area. No râles were present. Roentgenograms showed an extensive shadow over the upper two thirds of the left lung. The heart was not displaced to the left. A diagnosis of actinomycosis was made, and was confirmed by finding the sulphur granules of actinomycosis in the stained smear of material aspirated from the mass. The tumor was curetted, and small doses of potassium iodide were administered. This dose was gradually increased to 90 drops a day. The general condition improved, the sinuses closed, and the patient was sent home. He was not regular in taking the drops and returned to the hospital after being at home for about two months. Another large mass had appeared on the wall of the chest, and the child had lost some weight and was coughing. Large doses of potassium iodide were given, and the sinuses were curetted. He is now getting 106 drops three times a day, making a total of 318 drops a day. There are no signs of iodism, the patient's appetite is very good, and he is moderately active. The physical findings and roentgenograms show improvement, and it is hoped that this case will prove contrary to the usual prognosis of pulmonary actinomycosis.

TREATMENT OF CHRONIC NEPHRITIS WITH A DIET HIGH IN PROTEIN AND IN VITAMINS. DR. C. A. ALDRICH, Chicago.

In a recent number of *The Journal of the American Medical Association,* I reported results obtained with a diet high in protein and in vitamins which I interpreted as suggesting that patients with chronic nephritis benefited by such a dietary regimen. At that time three patients had been seen who were apparently well following that treatment after years of illness under the old low protein, salt-free dietary system, and many others seemed to be improving.

I thought it might be of interest to you to see how some of these children look while undergoing treatment. These children represent an unselected group,

less than half of the patients with chronic hematuric nephritis under observation at the present time. All are up and about, going to school or leading a normal existence.

Results of Treatment

			Nonprotein Nitrogen		Blood Pressure		Albumin		Microscopic Examination		
Patient	Age	Onset	Before Treatment	After Treatment	Before Treatment	After Treatment	Before Treatment	After Treatment	Before Treatment	After Treatment	Present State
E. J.	1½	+	28.6	24.8	126	102	4+	4+	B1 4+ C 3+	0 0	Slight edema
E. K.	6½	+	60.0	28.7	128	110	4+	0	B1 4+ C 4+	0 0	Well 2½ years
R. S.	5½	0	120.0	32.0	124	144	3+	0	B1 3+ C +	0 0	Well 2½ years
R. G.	3½	0	58.0	27.3	164	105	4+	Trace	B1 4+ C +	0 0	No symptoms
O. K.	2½	..	80.0	37.6	134	125	4+	Trace	B1 + C +	0 0	No symptoms
R. B.	8	..	59.0	39.4	150	120	3+	2+	B1 + C +	+ 0	No symptoms
A. H.	2	..	35.0	28.0	142	110	4+	3+	B1 2+ C 2+	0 0	No symptoms

MEDICAL SCARING OF CHILDREN. DR. B. I. BEVERLY, Chicago.

Next to parents, perhaps the most frequent source of fears in children is medicine, including physicians, hospitals and nurses. Bernice P., a girl, 10 years old, was brought for examination because of nervousness. The mother was convinced that the child was ill. She complained of severe pains over the heart, of abdominal distress and of headaches, and often had spells "when she stared in front of her and shook all over." This was first interpreted as epilepsy, but a more careful history indicated that she was trembling. The mother described a complete change in personality following scarlet fever four years before. Since that time she had refused to play with other children, insisted on staying in the house and was not getting on well in school. The results of physical, including neurologic, examination were negative. After gaining the girl's confidence, it was found that she had vivid memories of her previous entrance to the hospital and recalled the impressions made at that time. She was taken to the County Hospital with scarlet fever, and abscesses of the ears developed subsequently, which necessitated paracentesis. When the child went to the hospital she thought that she had been taken away from her mother and would never see her again. The mother had made the error, as many mothers do, of telling her that if she did not behave she would take her to the hospital. The child was convinced that she was going to die, and this conviction was further increased when the abscesses in her ears were opened. After rationalizing these false impressions and other factors in the case, her behavior became practically normal. Her pains and spells have entirely disappeared and she is getting on well in school and with other children.

Tony J. was brought to the dispensary with a history of nervousness since he was in the hospital six months before. He cried a great deal, and was irritable and a disturbing element in the home. He had been admitted to the hospital for an orthopedic operation on his wrist. The impression that this boy had at that time is as follows: His mother told him that she would take him home from the hospital the same day that he was admitted. When he found this to be a lie, he thought that he had been taken from his mother for good. When he came out of the anesthetic with his hand in bandages he thought that it had been amputated. His further description of his experiences was that he began to cry and scream. When asked what was done when this occurred, he said, "They put me in a room

by myself, closed the door and left me there." Much time was required in trying to straighten out these fears. It is doubtful that they will ever entirely disappear.

John J. began to stammer after a circumcision. Before the operation was performed he was told facetiously by a stupid mother that the physician was going to amputate the penis, and following the operation he was convinced that serious damage had been done. He began to stammer. Such conditions as these occur altogether too frequently, and, what is most important, the fears could be reduced to a minimum by proper psychologic management.

Any medical procedure and especially surgical procedures frighten children. Every person who enters a hospital is scared. This fear is needlessly exaggerated in children by wrong management. In order to make clear what I mean by wrong management, one must consider that which stimulates fear in people and what measures one can take to meet the situation. Fear is a normal instinctive emotion. Any time one's preservation is threatened one feels scared. Any time one's security is undermined one feels scared. With this in mind, consider what often happens when a child is admitted to the hospital for such a simple procedure as a tonsillectomy or a circumcision. He is frequently lied to by his parents—"You are going to a party," for example—and is ignored by the physicians. The child soon learns that he has been deceived by his parents, his sense of security is undermined, and he is scared. He is separated from his parents when he enters the hospital, or at least when he goes to the operating room. As he approaches the operating room he smells the peculiar odor of ether and sees a number of knives—with which he believes he will be hurt—and sees every one dressed like a ghost. He is then placed on the operating table, strapped and held down by two or three adults and asphyxiated or strangulated into unconsciousness. At best, an anesthetic is not much more than this. And when one sees some of the terrible methods by which anesthetics are administered to children, perhaps this is putting it mildly. He finally wakes up feeling sick, and vomiting and seeing blood. His parents having lied to him, he naturally does not know what is going to happen next. Each of these factors can only stimulate fear.

CYSTIC HYGROMA. DR. J. L. REICHERT, Chicago.

Cystic hygroma, or cystic lymphangioma, is the term given to a group of congenital tumors which consist of thin-walled, multilocular cysts lined with endothelium, lying in a cellular stroma, with no true capsule and filled with a fluid which transmits light readily.

There is some question as to their nature. They have been described as simple modifications of preexisting lymph structures, consisting merely in varicosities of lymph vessels with secondary cystic degeneration; that is, cystic lymphangiectases. On the other hand, they are described as true neoplasms caused by the proliferation of embryonic lymphatic rests, or of an embryonic parent cell; in other words, lymphangio-endotheliomas.

Clinically, there are two types of hygromas: those which act as benign tumors, and those which have the characteristics of a malignant process. Six cases are presented illustrating the differences in types. One is located in the neck, three in the neck and thoracic cavity, one on the wall of the chest and one over the sacrum. The benign type is soft, grows slowly, has only a moderate tendency to extend or to burrow and is resistant to direct or hematogenous infection. Hygromas of this type respond to various forms of treatment such as compression, the injection of coagulants and partial or complete removal, although radium and roentgen rays are the preferable form of treatment. They require relatively small doses.

The malignant type is tense, has periods of rapid growth, has great power of penetration and extension and shows a tendency to become infected. In this type surgical intervention is impracticable, because of the impossibility of removing completely a tumor without a limiting capsule and with such wide ramifications. Partial removal and aspiration are dangerous, because of the probability of infection. Radium in large doses is the treatment of choice.

SYPHILIS WITH NEPHRITIS. DR. HAROLD A. ROSENBAUM, Chicago.

Nephritis occurring with congenital syphilis, in my experience, is not common. There are cases, however, which are closely associated with congenital syphilis and which are difficult to explain on any other basis. Necropsies of fetuses, infants and older children who have had syphilis frequently show more or less involvement of the kidneys, such as glomerular changes, areas of atrophy, fibrosis, round cell infiltration and, more rarely, diffuse interstitial changes and contraction of the kidneys. This leads one to believe that nephritis may be the result of syphilitic infection. A. R. Rich thinks that there is a peculiar and specific form of nephritis associated with acquired syphilis. On the other hand, there are those who think that syphilis does not produce nephritis and that nephritis which appears with syphilis is due to a secondary infection. This undoubtedly occurs in many cases; however, in many there is no such evidence, and recovery follows antisyphilitic treatment, if not too severe and if secondary changes have not occurred.

During the past twelve years there have been nearly 400 cases of congenital syphilis at the Children's Memorial Hospital, and of this number there were 4 cases of syphilis with clinical nephritis. I can add as a fifth a case from my private practice sent to me four years ago.

My observations have led to these conclusions: 1. Syphilis can cause nephritis with anasarca, which yields to antisyphilitic treatment, if not too severe. 2. Cases complicated by secondary infection offer a grave outlook. 3. Secondary contraction of the kidneys may result in long-standing conditions causing deficient elimination and a tendency to uremia. 4. Good development is compatible with chronic involvement of the kidneys, if the renal function is good.

THREE CASES OF LEUKOPENIA. DR. MILA I. PIERCE, Chicago.

It is apparent to physicians who see a number of patients with disorders of the blood and blood-forming organs that a clearcut diagnosis is often difficult, and that considerable overlapping occurs among the types formerly recognized as clinical entities. Detailed observation and study of the blood seem only to add to the confusion, so variable are the findings at different stages of the disease process. However, until the normal physiology of the blood and blood-forming organs is more thoroughly understood, it is necessary to struggle with apparent inconsistencies in an attempt to see the picture as a whole.

This case presents infection with leukopenia. The blood showed: hemoglobin, 30 per cent; erythrocytes, 2,030,000; white cells, 1,400, and neutrophils, 18 per cent. The condition showed no improvement after three transfusions of blood. Pentose nucleotide in doses of 5 cc. was given intramuscularly twice a day for thirteen days. The white cell count rose to 5,000 and the neutrophils to 66 per cent. The child is now receiving yellow bone marrow by mouth.

The second patient had a history of many attacks of hematemesis with enlargement of the spleen. The platelets numbered 150,000. This condition was diagnosed as Banti's disease, and the spleen was removed.

The last case was one of enlargement of the spleen and liver with a reduction of the platelets and granulocytes. A diagnosis of Banti's disease or thrombosis of the splenic vein should be considered.

THREE CASES OF PURULENT PERICARDITIS WITH RECOVERY. DR. STANLEY GIBSON, Chicago.

These cases of pericardial effusion with recovery are of interest as the prognosis is usually grave. In the first case, pericarditis complicated osteomyelitis of the femur. A positive culture was obtained from the pericardial fluid.

The second case presents a complication with lobar pneumonia in which sterile fluid was obtained. As the effusion had been present for some time it is possible that earlier drainage would have yielded a positive culture.

The third case is remarkable in that with osteomyelitis, repeated positive blood cultures of Staphylococcus aureus-haemolyticus and signs of pericarditis, recovery occurred. In this case the signs of effusion were moderate, so the pericardium was not opened.

The first two cases illustrate the fact that pericardial drainage should be instituted when an effusion sufficiently large to cause distress occurs. Surgeons are agreed that surgical intervention and not paracentesis is the proper procedure.

TRICHINOSIS. DR. GEORGE EISENBERG, Chicago.

This child was admitted to the hospital on Aug. 31, 1933, having been ill for about six days. The onset was acute. One of the first symptoms noted was the edema of the face, particularly of the eyelids. Simultaneously the patient had an acute gastro-intestinal upset, with severe nausea and a temperature ranging from 102 to 104 F. She said that her feet hurt when she walked from the cart. The examination revealed not only edema of the eyelids, but some tenderness in the calves, there being pain on pressure. The entire body became sensitive to pressure; pressure on the calves, thighs and shoulders elicited tenderness of the muscles and she moved with extreme pain. Tests of the blood showed the number of eosinophils to be above normal, from 35 to 45 per cent.

A brother was admitted to the hospital with the same symptoms, but was much less sick, and had practically no tenderness of the muscles. Blood smears showed the same picture of eosinophilia.

Two days later another member of the family with the same condition was admitted. She was sick intermittently. She was the only member of the family who was ill, but blood smears of the rest of the family showed an eosinophil count of from 25 to 35 per cent.

The edema of the face, particularly of the eyelids, when not explainable on a cardiac or a nephritic basis, the acute gastro-intestinal upset, the eosinophilia of high degree, combined with a history of illness of other members of the family and recent eating of pork, usually make the diagnosis easy.

The boy went home after three or four days. The temperature dropped to normal, and the edema disappeared. The temperature of the second girl, who was moderately ill, dropped in about ten days, and the soreness of the muscles disappeared gradually. This girl, however, had a constant high fever of from 102 to 104 F., and instead of the soreness in the muscles becoming better it increased. A little of the edema can still be seen, but gradually, after a few weeks, the fever was reduced, and the soreness in the muscles abated.

From 3 to 5 per cent of the patients with this condition undoubtedly die of bronchopneumonia or other complications.

EARLY STEPS IN THE DEVELOPMENT OF AIR CYSTS. DR. WILLIAM E. ANSPACH, Chicago.

Four cysts have been observed in infants. Two held fluid when first seen; two others contained air. One of the former ruptured into a bronchus, and its fluid contents were coughed up or swallowed. Air replaced the fluid within the wall of the cyst, and, because of a valvelike mechanism at its orifice, the cyst ballooned out with air. Since the first report of this case, other cases have been seen to make these changes. It appears that congenital cysts first contain fluid and then fill with air after birth.

BRONCHIECTASIS. DR. WILLIAM E. ANSPACH, Chicago.

The recognition of the triangular density in the cardiohepatic angle as a collapsed lobe, before any pulmonary symptoms simulating those of bronchiectasis appear, and observations at necropsy or over long periods in which bronchiectasis later developed offer an explanation of a common form of bronchiectasis not pre-

viously recognized. If complete collapse persists long enough, atrophic changes occur which weaken the bronchial walls. The increased negative intrapleural pressure, resulting from the decreased intrathoracic volume, brings about bronchial dilatations. If the process at work is recognized soon enough and bronchial drainage is instituted, these changes may not occur.

SELF-SELECTED DIETS FOR CHILDREN. DR. CLARA DAVIS, Chicago.

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RHEUMATIC FEVER. DR. G. F. WEINFELD, Chicago.

The epidemicity and the familial nature of rheumatic fever have long been recognized. It has frequently been shown that epidemics of rheumatic fever occur particularly when large numbers of young adults are grouped together, as in military camps and on university campuses. Epidemics occurring among groups of children in hospitals convalescing from rheumatic heart disease have been reported several times. The simultaneous occurrence of attacks in several members of a family is a fact well known to workers associated with a clinic for children with cardiac disease.

My associates and I tried to determine how frequently multiple, simultaneous or sequential outbreaks of rheumatic activity occurred in the families registered in our clinic for diseases of the heart. In examining the records of the past seven years it was found that there were twenty-three families of which more than one child was registered in the clinic. There were forty-nine children in this group. We accepted for this study only those families in which there were multiple cases with conditions definitely diagnosed as rheumatic, and seen by us during the attacks. Only ten of these families, with twenty-three children, met this requirement.

The frequency with which simultaneous attacks occur in families is probably higher than this study indicates. This investigation was limited to a narrow age zone, the questionnaire method of obtaining data was not employed, and only the cardinal signs of rheumatic infection were accepted as evidence of an attack.

The notoriously long and variable latent period and the insidious manner with which some of the manifestations begin are responsible for the absence of a more or less definitely established period of incubation for this disease. It is therefore difficult to determine with any great degree of accuracy what constitutes concurrent attacks or to be certain that the multiplicity of clinical explosions resulted from the same etiologic spark.

We found simultaneous or, what seemed to us, related attacks in seven of our ten families. Brief summaries of their histories reveal the interesting manner in which these attacks occurred.

Friday Afternoon, Sept. 22, 1933

ROBERT A. BLACK, M.D., *Chairman*

POLYDACTYLISM IN FIVE GENERATIONS. DR. L. J. BRODY, Chicago.

Definite congenital anomalies are always of interest. The degree of interest varies with the infrequency of the condition and with the hereditary tendency. We are accustomed to think of polydactylism as a common abnormality of a finger, thumb or toe. These supernumerary digits, ordinarily imperfectly developed, are appendages of other digits which may or may not be normal. There is a definite hereditary tendency for this abnormality, and it shows a decided similarity to the analogous condition in the fowl and the dog in its transmissibility from one generation to the next.

Some attempts have been made to link this abnormality with the theory of Darwinsim, as a reversion to the primitive. Howes and Hill, writers on the subject, as well as others have proved conclusively that accessory digits are due to fission, and that any increase or decrease from the normal number (five) is to be regarded as a specialization. Several instances have been reported in which the abnormality could be traced to four generations, and one instance was reported in which it had been traced to six generations. In each of these cases there was some other abnormality, or the digits were imperfectly formed.

This case is brought to your attention on account of the seemingly well developed extra toe, the hereditary tendency for five generations and the variation in the many members of the family.

Geraldine was admitted to the hospital to have the supernumerary digit on each foot removed. The father did not want his child to go through the discomfort that he and his sister have been experiencing because of pressure from shoes. In addition, he thought that if the extra digit were removed, his child's children would not have the same stigma, for in the family only those parents with six toes had offspring with the same abnormality.

Our patient, who is 3 years old, is otherwise a healthy child. In both feet there is a bifurcation of the fifth metatarsal bone near the center of the shaft, the distal end being Y-shaped, with two sets of phalanges articulated with the double distal ends.

We can trace this condition to five generations. (To date our data include the findings of only one branch of the family tree.) Several interesting factors present themselves in this study. 1. With the exception of the great-great-grandfather and the father of this patient, the anomaly is transmitted through the female element of the family. 2. The six toe element is transmitted in only one branch of the family, while in the other branch, both supernumerary toes and fingers are evident.

The questions placed before me by the parents of the child were these: 1. If we have more children will they of necessity have six toes? 2. Will there be a possibility of them having six fingers? 3. Will the removal of this extra toe protect our child's children from having this abnormality? 4. Is this to be considered as a disease?

TRANSVERSE MYELITIS WITH RECOVERY. DR. M. C. O'HERN, Chicago.

The patient is 13 years old. She has had the usual diseases of childhood, except diphtheria and scarlet fever, and the tonsils were removed several years ago. The family history is unimportant.

The patient was in perfect health up to Dec. 19, 1932. In the forenoon of that day she felt weak and was unable to keep her mind on her work at school, pain developed under both shoulder blades, and she felt nauseated and asked to be sent home. On the way home numbness developed in the right leg. This numbness advanced rapidly and by the afternoon had spread as high as the costal margins. The left leg became numb in the same way, so that by evening both extremities were involved.

The patient had vomited once, and complained of chilliness and headache and of the numbness in the lower extremities. She was unable to stand, but could move the legs slightly. There were no changes in the reflexes, but there was marked impairment of the sensation to light touch. Paresthesia and flaccidity were present. The following day the patient was admitted to the hospital.

Physical examination showed complete flaccid paralysis, numbness and paresthesia of both lower extremities extending to the margins of the seventh rib around the trunk. The abdominal reflexes were absent; the knee jerks were present, but sluggish, and Babinski's sign was marked on both sides. There was no rigidity of the neck or spine, and there were no tremors. The patient seemed calm and composed. There was a slight headache with some pain in the lower extremities and the back. There was incontinence of urine. The temperature was 100 F.;

the pulse rate, 84, and the respiratory rate 20. The spinal fluid was clear, and the pressure was increased. There was a slight reduction test (64.5) and there were 24 lymphocytes per cubic millimeter. The Pandy test was 1 plus, and the Ross-Jones, the Kahn and the Wassermann tests were negative. A culture, after incubation for fourteen hours, was negative.

The blood count showed: hemoglobin, 75 per cent; red cells, 3,100,000; white cells, 24,000; polymorphonuclears, 63 per cent; lymphocytes, 16 per cent; monocytes, 18 per cent; eosinophils, 2 per cent, and basophils, 1 per cent.

The incontinence continued so that the bladder was kept empty fairly well without the use of a catheter. The bowels had to be moved by enemas. The patient complained of a moderate amount of pain in the lower extremities for about three weeks, at which time the pain began to subside and she was able to move them a little. By the end of the fourth week she was able to sit in a wheel-chair. About this time control of the bladder began to return and in six weeks had fully returned. At the eighth week the bowels were moving normally. The knee reflexes, which were sluggish at first, became exaggerated.

The condition of the patient continued to improve so that by the fifth month she was able to walk alone. At the present time she walks very well, but has a little difficulty when she tries to run, although she says that even that condition is improving. The only residual findings at the present time are the exaggerated knee jerks and a bilateral Babinski sign. The abdominal reflexes are still absent.

INJURIES OF THE LIVER OF THE NEW-BORN. DR. ARTHUR R. TURNER, Chicago.

CONGENITAL ATRESIA OF THE BILE DUCTS. DR. PHILLIP ROSENBLUM, Chicago.

This patient is presented to emphasize the fact that congenital obliteration or atresia of the bile ducts can often be corrected by proper and early surgical intervention.

This baby, now 18 months old, was born normally at full term. Jaundice developed on the second day and increased in severity. There was some vomiting, and the gain in weight was a little less than normal. The umbilicus bled on the eighth day, and there was slight vomiting of blood-tinged material.

The liver was enlarged to almost the level of the umbilicus, and the urine contained bile. No pigment was found in the stools, but the icteric index was high. In view of the persistence of the jaundice an operation was advised when the baby was 8 weeks old. The weight at birth was 6 pounds and 11 ounces (3,039.3 Gm.) and at the time of the operation, 8 pounds and 4 ounces (3,742.14 Gm.).

The operation, which was performed by Dr. Alfred Strauss, revealed an empty atrophic gallbladder and fibrous tissue in place of the cystic and common ducts. In the region of the hepatic duct was a cord of fibrous tissue extending to the liver. Surrounding this fibrous cord were large inflammatory glands buried in alveolar tissue. This fibrous cord was incised, and with pointed forceps a passage was established up to the liver at what corresponded to the hepatic duct. At this point a little thin, yellow fluid escaped. The lumen thus established to the liver was enlarged by spreading the forceps enough to admit a no. 10 F catheter, which was sutured in place. The catheter was then brought through a stab wound in the right rectus muscle.

Three days following the operation, bile came through the catheter and the amount increased to about 3 ounces (90 cc.) daily. This was included in the feedings. When the catheter was removed a little about fifteen days following the operation, it was noticed that bile was no longer coming through, and that the stools contained bile. A pressure necrosis by the catheter caused a communication into the intestine at the duodenum. Nature thus obviated a second operation. The catheter was removed a few days later, and the wound healed promptly. The jaundice disappeared, and to date, sixteen months later, the baby has remained in perfect health. The liver has receded almost to normal size.

A piece of the liver removed at operation for section showed marked jaundice of the liver with bile thrombi and marked fibrosis, but without the formation of bile ducts. There was no necrosis of hepatic cells. As a result of the backing up and retention of bile, fibrosis resulted showing that an infection is not always necessary to cause cirrhosis.

All infants in whom a congenital obliteration or atresia of the bile ducts is suspected should be given the advantage of surgical intervention before a pathologic condition leads to fatality.

THESAURISMOSIS GLYCOGENICA (VON GIERKE). DR. KATSUJI KATO and DR. ELEANOR M. HUMPHREYS, Chicago.

Thesaurismosis is a generic name first proposed in 1931 by von Gierke, who attempted a classification of all storage diseases on the basis of the substances stored. Anatomically, the majority of storage diseases demonstrate a marked activity of the macrophages of the tissue, causing the reticulo-endothelial system to undergo abnormal hypertrophy, caused by phagocytosis and proliferation. Other parenchymatous tissues, such as the myocardium, the skeletal muscle, the liver and kidneys, the bones, the ganglion cells, the suprarenal glands and the adipose tissues as well as the leukocytes of the blood, are also capable of pathologic storage of various substances. The conception of a storage disease involving glycogen as the specific substance, as set forth by von Gierke, has opened a new approach in the study of some obscure cases of enlargement of parenchymatous organs.

An effort to formulate a picture of the pathologic anatomy as well as of the clinical syndrome of glycogen storage disease may be premature. In none of the cases reported have comprehensive clinical studies been made, and only a few diagnoses have been proved by complete autopsy. From the proved cases, it appears that this peculiar condition of organ hypertrophy associated with an enormous deposition of glycogen, and without other essential or constant abnormality, occurs in infants and young children. The disease may be divided into (1) hepatonephromegalic and (2) cardiomegalic types, depending on the site of major localization of the carbohydrate. It must be remembered that in both forms glycogen is usually found in other organs, only in smaller quantities. Recently, van Creveld published the observations of Deelman, who suggested the association of glycogen storage with hypertrophy of the smooth muscle fibers in cases of congenital pyloric stenosis.

THE VALUE AND LIMITATIONS OF ENCEPHALOGRAPHY. DR. A. LEVINSON, Chicago.

Encephalography has been of value in demonstrating the location of a tumor of the brain, if not in the fourth ventricle. It tells whether a condition is hopeless, or whether one may expect results from treatment. In acute conditions in which the pressure is increased, as in meningitis, introduction of air may give an additional amount of fluid, and in some cases convulsions have been checked, at least temporarily.

One thing to be considered is the technical limitations. The apparatus on the market today is expensive and is sometimes hard to handle. It is difficult to decide how much air to inject. Instead of 60, 70 or 80 cc., many of us try to inject as much as we can to replace the fluid. The question of anesthesia arises. It is necessary to anesthetize the patient; otherwise he moves and there is injury. Morphine and avertin should be at hand, with chloral hydrate, and the minimum amount necessary should be used.

The study of the fluid obtained from different levels is interesting; the question of whether it is the same in all levels or whether it changes opens an entirely new field of study of the spinal fluid. The symptoms are important. The children are restless, and complain of headache after the injection of 30 or 40 cc. Appar-

ently the air produces pressure. Then, there is the slow, irregular pulse. Sweating is an important symptom. Collapse does not happen very often, but may occur. Most children are dehydrated by the procedure, in which event physiologic solution of sodium chloride or dextrose given intramuscularly a few hours after the operation will combat this. The best position for taking a roentgenogram is with the patient sitting up, taking an anteroposterior, postero-anterior and two lateral views. One should know what to look for and what to interpret.

Encephalography has its limitations, but has value if one knows how to do it and realizes that it is important to be familiar with the anatomy of the brain, including the ventricular and the subarachnoid system.

THROMBOCYTOPENIC PURPURA (PURPURA HAEMORRHAGICA): REPORT OF TWO CASES. DR. H. W. ELGHAMMER, Chicago.

Helen C., an American girl 3 years old, born on Sept. 12, 1929, was first seen on the evening of Jan. 9, 1933. While playing she had fallen and sustained a cut of the upper lip. The wound bled profusely, and a large hematoma formed, covering the lips and extending into the cheek. The condition appeared to be out of proportion to the injury. On further examination ecchymotic areas of varying size were found on several portions of the body. The mother stated that some of the "bruises" had been present for two days. The child had complained of pain in the abdomen the previous day; a dose of magnesium hydroxide had resulted in a large "black" stool.

The child was taken to the hospital. Physical examination revealed a well nourished girl, rather pale, with a yellowish tint to the skin. There were many ecchymotic areas all over the body, profuse bleeding from the mouth and several bloody bowel movements. The family history was irrelevant. There had been a normal birth. At the age of 5 months an intussusception had been successfully operated on. The child had had whooping cough in the summer of 1932 and bronchopneumonia in December, 1932. Laboratory tests revealed erythrocytes, 4,030,000; leukocytes, 5,200; a normal differential count; hemoglobin 70 per cent, and platelets, 10,000. These observations prompted a diagnosis of thrombocytopenic purpura.

Fifteen cubic centimeters of the father's blood was given subcutaneously and 10 cc. of calcium gluconate intramuscularly; this was repeated every twelve hours during the first three days. The red cell count and the percentage of hemoglobin decreased steadily, the number of platelets remained low, and the bleeding was continuous. There was a definite leukocytosis in response to the continuous hemorrhage. On the third day high voltage roentgen exposure was given the spleen—a rather heavy dose of one fourth of an erythema dose. The bleeding continued; the patient's condition appeared to be critical, and she was given an indirect transfusion of 180 cc. of her father's blood. The temperature had been normal up to this time. Four hours following the transfusion, the temperature rose to 105 F., promptly subsiding within twelve hours. The spontaneous bleeding stopped. The child was given a diet high in protein and fat, together with large amounts of vitamins A and D and liberal amounts of gelatin. The patient was discharged from the hospital on January 25, with a normal blood count, 90,000 platelets and a bleeding time of six minutes. Ten days after the roentgen exposure there seemed to be a progressive improvement in the blood picture. On March 18 the blood count was: red cells, 5,100,000; white cells, 8,200; hemoglobin, 89 per cent; platelets, 140,000, and bleeding time, one minute. On September 9, the blood findings were the same, with 180,000 platelets and a bleeding time of four minutes.

Genevieve S., a Polish girl, 15 years of age, born on April 14, 1917, was admitted to Mercy Hospital on Nov. 6, 1932, with the complaint of uterine hemorrhage for the past three weeks and bleeding from the nose, mouth and throat for one month. The girl appeared to be acutely ill. She was extremely weak, with marked pallor of the skin and mucous membranes. There was profuse bleeding from the gums, the tonsils and the tongue, and a continuous flow of blood from

the genitalia. The extremities were covered with small and large ecchymotic areas. The family history was irrelevant. The past history revealed nothing essential. Laboratory observations showed: erythrocytes, 1,870,000; leukocytes, 4,100; hemoglobin, 35 per cent; platelets, 8,000, and the urine normal. A diagnosis was made of thrombocytopenic purpura.

The patient's condition was grave, and during the ten days following admittance she received four transfusions of blood of a total amount of 2,400 cc. or about 2½ quarts. The hemorrhage persisted. High voltage roentgen therapy was applied to the spleen. During the following ten days the patient was given five treatments with roentgen rays, with a total dosage of 1½ erythema dose. Five more transfusions of blood were given, making a total amount of 3,700 cc. or about 4 quarts. There was no improvement in the condition until three weeks after the roentgen therapy was administered. At this time the last two transfusions of blood were made, which resulted in a marked improvement, both in the general condition and in the blood picture, with red cells, 3,500,000; white cells, 4,500; hemoglobin, 60 per cent; platelets, 90,000, and complete cessation of the hemorrhage. The patient was discharged on December 25. There has been no recurrent hemorrhage. The menses have been regular and of three days' duration. Two teeth were extracted a month ago without prolonged hemorrhage, and the blood picture at present is: red cells, 4,200,000; white cells, 7,650; a normal differential count; hemoglobin, 80 per cent; platelets, 184,000, and bleeding time, three and one-half minutes.

My associates and I think that the large amount (6,100 cc., or 6½ quarts) of blood given to this patient sustained her life, and that the roentgen therapy inhibited the destructive action of the spleen, enabling the blood to regain its normal function of clotting.

We regard both of these as arrested cases of purpura. Will the condition remain arrested or will there be a recurrence? Has the high voltage roentgen therapy permanently destroyed the disturbing action of the spleen or will splenectomy be necessary in the future?

A Vegetable Concentrate Combined with Irradiated Yeast. Dr. M. Jampolis and Dr. D. B. Witt, Chicago.

This presentation is a preliminary report on the use of a powdered concentrate of spinach, carrot and tomato, combined with irradiated yeast, which was supplied to us by the Biovegetin Products Company. Biologic assays show that 6.5 Gm., or 4 teaspoonfuls, of this powder contains 930 Steenbock units of vitamin D and the equivalent of 22 cc. of fresh orange juice in vitamin C potency.

The purpose of our investigation was (1) to determine whether vitamins C and D were present in sufficient quantity to obviate the further addition of these vitamins, (2) to note the effect of the preparation on nutrition and development and (3) to observe the effect on the gastro-intestinal tract.

Eleven infants have been observed thus far. Fearing that young infants might show signs of gastro-intestinal irritation, at the beginning of the investigation a group of four infants was selected varying in age from 4 to 6 months; later, the investigation was continued with a second group of seven infants from 2 to 4 weeks old. The children were hospitalized in the department of children's diseases of Michael Reese Hospital during the entire period of investigation in order to control accurately the conditions of the experiment. All the infants were fed modified evaporated milk or mixtures of cow's milk. The preparation of vegetable concentrate and yeast was added to the milk before bottling, starting with from ½ to 1 teaspoonful, and gradually increasing to 8 teaspoonfuls a day for the infants in the first group. The second group, which is still under observation, has been given 4 teaspoonfuls a day. No orange juice, cod liver oil, viosterol or irradiation was given. Farina was added after the infants had reached the age of 4½ months.

This study included daily records of weight, notations as to vomiting, careful observations of stools, roentgenograms of the long bones at intervals of three and

four weeks, determinations of the blood calcium, phosphorus and iron at similar intervals and frequent determinations of the hemoglobin (Newcomer).

Our observations thus far suggest these conclusions: 1. This preparation affords a ready means for feeding vegetables early. 2. All the infants took the mixture willingly. Vomiting was seldom noted. The stools were normal in consistency and frequency and pea-green in color. 3. All the infants thrived normally. 4. No diarrhea was noted except on one occasion when two babies in the first group were victims of an epidemic of infection of the upper respiratory tract which was accompanied by an increased number of stools for a few days. The diarrhea cleared up without elimination of the vegetable mixture from the feedings. During the remainder of the period of observation the stools remained normal. 5. None of the infants in the second group, who have been in the hospital since May, have had either colds or diarrhea. 6. In three infants the hemoglobin values remained above the average normal level throughout the period of observation. In the remaining infants, who are still under observation in the hospital, the hemoglobin values were below the average normal during the early months. Later determinations showed the hemoglobin values equal to or slightly above the average normal. 7. In none of the infants did any signs of rickets or scurvy develop during the period of observation. 8. One infant, who presented evidence of mild rickets with craniotabes on admission, showed healing within three weeks after the mixture was included in the diet.

CHOREA: IS IT A MANIFESTATION OF RHEUMATISM? DR. J. R. GERSTLEY, DR. S. A. WILE, DR. E. FALLSTEIN and MAE GAYLE, B.A., Chicago.

Since chorea is generally accepted as a manifestation of rheumatic infection, we thought that an intensive study of patients with chorea over a long period might aid in a better understanding of rheumatic fever.

Fifty-eight children who had chorea and who had been attending a special "chorea clinic" during the past six years form the basis for this study. In addition, a survey was made of one hundred and fifty children in a camp for cardiac disease, with reference to the incidence of chorea in the past history. All patients with chorea were studied clinically in the hospital, discharged to a convalescent home if necessary and then kept under observation at the clinic. A review was made of all patients with chorea. All the patients had a final examination, at which time a fluoroscopy of the chest and an electrocardiogram were made.

Briefly, the essential facts gleaned from this study are: 1. The family history is predominantly neurotic. 2. Domestic discord is common. 3. Poverty and poor environment are present in most cases. 4. The ratio of females to males is 2:1. 5. The oldest child is most often afflicted. 6. The patients themselves are generally of a neurotic temperament, conscientious, worrisome and often of an introspective nature. 7. Many of the males have accentuated feminine sex characteristics. 8. The chorea seems to subside spontaneously at or about puberty. 9. The history of some psychic trauma occurring shortly before the onset of the chorea can frequently be obtained. 10. Chorea was infrequently associated with a history or evidence of rheumatic fever in our patients. Only six of the fifty-eight patients gave a definite history of a rheumatic infection, and there were only fourteen with even a doubtful history. 11. There is nothing in the clinical or laboratory findings which suggests that uncomplicated chorea is an infection. 12. It would seem that permanent damage to the heart rarely follows uncomplicated chorea. Only those patients who gave a history of rheumatic infection, and particularly those in whom tonsils were present, showed endocarditis. While systolic murmurs over the apex are common in chorea, in their course and prognosis they differ entirely from the systolic murmurs noted in rheumatic infections. Of the one hundred and fifty children at the camp for cardiac disease, only nine gave a history of uncomplicated chorea, and in five of the nine there was a question of an actual cardiac pathologic condition. 13. Since the organization of the special clinic for chorea, we have had very few recurrent attacks among our patients who have attended regularly.

We fully realize that the results of such a study may be interpreted differently by various workers. It seems to us, however, that these findings suggest that

chorea may not be a manifestation of rheumatic infection, but possibly a clinical syndrome, occurring in a child constitutionally predisposed, as the result of shock from psychic trauma or from certain infections. Associated rheumatism or tonsillitis is of much greater importance in subsequent involvement of the heart than is chorea. The excellent results obtained in the clinic for chorea indicate the importance of improved environment and mental hygiene in these patients.

RUPTURED THORACIC AORTIC ANEURYSM IN A CHILD. DR. JOSEPH K. CALVIN, Chicago.

A white girl, 4 years old, was admitted to the hospital in July, 1932. The mother stated that the child was well until two weeks before admission, when pain developed in the abdomen and chest, and vomiting occurred. It was also noted that during the past two weeks the child had had fever. The developmental history was normal.

The physical examination revealed a well developed child who was acutely ill. The temperature was 103 F.; the pulse rate, 140, and the respiratory rate, 30. The cardiac area was considerably enlarged to the right and the left. A pericardial friction rub was heard along the left border of the sternum. The temperature varied between 100 and 104 F.; the rate of pulse and respiration continued rapid. The leukocyte count was 30,000, with 78 per cent of polymorphonuclears. A roentgenogram revealed a marked cardiac shadow, the configuration resembling pericarditis with effusion. The electrocardiogram showed evidence only of sinus tachycardia.

The clinical diagnosis was pericarditis with effusion. Because the high temperature and the respiratory and cardiac disturbance continued, a pericardial paracentesis was performed on the fifth day in the hospital, yielding 35 cc. of straw-colored fluid. About ten minutes later, the child became cyanotic and died.

Autopsy showed that the pericardial sac extended from the right mamillary line to the left anterior axillary line and contained 250 cc. of coagulated blood. The heart was hypertrophied and dilated. The valves of the heart were grossly unchanged. Beyond the arch of the aorta, 8 mm. below the opening of the left subclavian artery, on the anterior wall, was an oval opening 7 by 5 mm. in diameter. The intima was smooth except for small granular deposits near the lower edge. The opening led into a sac 7 by 5 cm., bulging into the pericardial sac. At the greatest convexity of the intrapericardial portion of the sac was an irregular hole 25 by 20 mm. in diameter.

Approaching the opening in the descending aorta, the first change to become visible on microscopic examination was a layer of fibrinoid material resting on the internal elastic membrane and containing irregular and shrunken nuclei. Near the opening, the layer was raised to nodular elevations, bent outward to pass into the internal lining of the sac. Beneath the nodular elevations the muscle and elastic fibers of the media were necrotic. The coarser elastic fibers were still visible, but were broken up into small pieces and curled, while the finer fibrils had disappeared. The adventitia was well preserved. Bacterial stains demonstrated streptococci in the nodular elevations. Sections taken from other portions of the aorta did not show abnormal change.

The anatomic diagnosis was verrucous aortitis of the descending portion, with formation of an aneurysm perforating into the pericardial sac.

Another slide of a section of a ruptured aorta in a child resulting from verrucous aortitis was shown.

In both of these cases, primary involvement of the intima is shown. The genesis of the lesion is probably at the point of attachment of the offending agent from the lumen of the aorta. A fibrinoid swelling of the intima occurs which rises above the surface of the unaffected intima. Later, a proliferation of the cells of the intima, chiefly fibrocytes, occurs with the formation of a nodule. This may then become necrotic, which necrosis penetrates the deeper layers, involving the media. If this is extensive, the weakened wall of the aorta may rupture with or without previous formation of an aneurysm. Because of the similarity of the

lesions of the aorta in the two cases, and the finding of Aschoff bodies in the myocardium in one, the verrucous aortitis may be assumed to have a rheumatic basis.

ABSCESS OF THE THYROID GLAND. DR. J. C. KRAFFT, Chicago.

Here is a girl, 6½ years old. She is the first of two children delivered normally by a midwife. The infant was given condensed milk at first, but she was very constipated, so olive oil was added. After a few months the formula was changed. She was very fat, was late in teething and walked when 16 months old. She had pyelitis at 23 months, and a tonsillectomy was performed at 4 years and 3 months. The father, a German, and the father's mother have asthma; the mother, a Hungarian, and the mother's brother have goiter.

When this girl was 4 years and 9 months of age she was brought to me because of a cold and frequent micturition. She had pyelitis. Two months later the urine was normal, but there was yellow discoloration of the skin, with no bile in the urine and no clay-colored stools, but marked constipation. The thyroid gland was enlarged, and the pulse was fast. There were still frequent urination and enuresis, and the afternoon temperature by mouth was 99.4 F.

As there were no symptoms in the eye at this time, she was given thyroid extract, 1 grain (0.065 Gm.), twice a day, in spite of the fact that she was of lanky build. Iodine was used locally. At this time she was of normal proportions, weighing 43¾ pounds (19.8 Kg.), with a height of 46 inches (109.22 cm.). The urine was normal. While taking thyroid extract she lost weight and became more nervous, and the symptoms appeared in the eye; the extract was stopped after twenty days, and potassium iodide was given. The enuresis disappeared entirely when thyroid extract was given. During the treatment with potassium iodide she gained 3 pounds (1.4 Kg.) in two months, but the pulse rate varied from 140 to 144, the blood pressure was 130 systolic and 80 diastolic, the metabolic rate was plus 24, and the blood count showed: hemoglobin, 70 per cent, and white cells, 7,800. She was then given compound solution of iodine and viosterol, but the blood pressure remained 115 systolic and 90 diastolic although she gained weight. All medication was stopped, and she was given carotene in oil, 10 drops twice a day. In eighteen days the blood pressure went down to 95 systolic and 55 diastolic, and in seven weeks the metabolic rate was plus 8. The symptoms in the eye have almost disappeared, the pulse is normal, there is no apparent nervousness, and the patient attends school.

ALLERGY: A PEDIATRIC CONCEPTION. DR. I. HARRISON TUMPEER, Chicago.

This ambiguous title serves equally the twin thesis of allergy as a pediatric conception and a pediatric conception of allergy.

Allergy as a pediatric conception was elucidated by a brief review showing that the very name of the specialty and its essential technics were contributed by pediatricians. The rôle of the other fields of medicine in the further development of allergy were next considered. Finally, the suggestion was made that further advances in the understanding of this constitutional disorder must again arise from the pediatric field.

A pediatric conception of allergy was explained by an illustrated and tabulated presentation, indicating certain common stigmas of infants manifesting allergic characteristics. It becomes apparent that the constitutional disorders formerly thrown into the classification of infantile diathesis belong to the constitutional disorder which is today called allergy.

The summary of the presentation indicates that allergy is a pediatric conception in the historical sense and that emphasis should be placed on the described pediatric conception of allergy.

RENAL RICKETS. DR. ROBERT E. CUMMINGS, Chicago.

D. M., a girl, aged 5 years, came under my care on Nov. 19, 1932, because of retarded growth and marked bowing of the legs. She was delivered by breech presentation, one month prematurely. Vomiting was a complicating symptom

during the first weeks of life. The child sat up at 6 months of age and walked at 16 months. At the age of 2 she had chickenpox, following which she could not walk, and the bones of both legs began to show marked bowing of the tibia first of the left leg and then of the right. Profuse sweating was a constant finding during the first two years. The first tooth appeared at 16 months. She had had many colds and infections of the ear. She has an agreeable disposition, plays well with children and seems to be of average intelligence for her age. The father and mother are first cousins. The Wassermann and Kahn tests were negative from both the father and the mother.

On admittance the child's weight was 26½ pounds (12 Kg.) and her height was 33 inches (83.82 cm.), indicating a markedly retarded growth. Extreme thirst and severe pigmentation of the skin were outstanding observations. She had all her teeth, there was a small perforation of the right ear drum, and the tonsils were moderately enlarged. The lungs were normal; a chronic murmur was heard. The blood pressure was 90 systolic and 60 diastolic. The Wassermann and Kahn tests were negative. The blood count showed hemoglobin, 52 per cent, red cells, 4,000,000, and white cells, 16,800. The differential count was essentially normal. The urine showed 15 pus cells per cubic millimeter; otherwise it was normal. The family left town; so I did not see the child until they returned on Aug. 11, 1933. Her weight at this time was 30 pounds (13.7 Kg.), and the height, 35 inches (88.9 cm.). All the symptoms and findings that she presented on the first examination were present, with perhaps an increase in the deformity of the right leg. The blood pressure was 86 systolic and 55 diastolic. The urine was normal. The blood count showed: hemoglobin, 60 per cent, red cells, 4,200,000, and white cells, 10,000.

A. Graeme Mitchell made an excellent analysis of the literature and presented many cases. In his cases, special mention was made of genu valgum in thirty-three cases, this being the most prominent manifestation of rickets. The average age of the patient at the onset is 5 years. An elevated blood pressure is seldom encountered in renal rickets. Mitchell advanced the theory that in this disease the kidneys fail to excrete the waste endogenous phosphorus from the body and that such waste is excreted through the intestinal mucosa instead of the kidney; this concentration of phosphorus in the bowel contents may interfere with the absorption of calcium from the food, through the formation of insoluble calcium phosphate, thereby leading to rickets from calcium starvation. The value of this hypothesis has yet to be appraised.

There is a form of rickets developing in childhood in connection with, and apparently as a result of, chronic nephritis. Extreme thirst, retarded body growth and pigmented skin are the most important findings. The blood pressure is not elevated in any reported cases. Evidence of rickets is always secondary to a chronic interstitial nephritis, and death results from renal insufficiency.

AN UNUSUAL INTESTINAL TUMOR IN A CHILD. DR. ARTHUR F. ABT, Chicago.

A large tumor involving the intestinal tract in a child is sufficiently uncommon to be worthy of report. Tumors arising from the intestinal tract may reach considerable size before producing symptoms which might draw attention to their presence. Constipation, complete obstruction, diarrhea or melena may be the first symptom of the presence of an intestinal tumor, depending on its nature and site of origin. On the other hand, actual abdominal enlargement, caused by the tumor mass or by ascites, when the peritoneum is involved, may be the first indication that a tumor is present. Pressure of a tumor on the great vessels may lead not only to transudation in the peritoneal cavity, but also to edema of the lower extremities. The length of time that the intestinal tumor may have been present before causing symptoms leading to its recognition will vary with the nature and site of the tumor, the rapidity of its growth, its benign or malignant nature, its pressure on or invasion of other organs and the nature and extent of the metastases.

The tumor which I am reporting occurred in a white girl 12 years of age; the symptoms had commenced with a mild diarrhea three months prior to coming under my observation. The child had from four to six bowel movements a day, and the stools were watery and brown. On questioning, the mother stated that she had never noticed bright blood in the stools, nor were they ever of a tarry, black nature. The diarrhea had cleared up a week previously; since then the stools were formed and were passed twice a day.

On palpation, a smooth, rounded mass, about the size of a fetal head, was felt in the right lower part of the abdomen. The mass was freely movable and not extremely tender. On manipulation, one could move the mass to the midline in one direction, and toward the anterior superior part of the spine and the flank in the other. In other words, the tumor gave the impression of being freely movable. The liver and spleen were not palpable; no fluid could be demonstrated in the abdomen, and there were no other masses palpable.

A preoperative, presumptive diagnosis was made of an intestinal tumor in the region of the ileocecal valve. The etiology of the tumor mass was thought to be either a walled off appendical abscess or a neoplastic growth of intestinal origin. Dr. Alfred A. Strauss performed the operation. When the abdominal wall was opened, access being gained through a right rectus incision, a tumor was exposed which was not of retroperitoneal origin, nor was it part of the liver or kidney The omentum was firmly fixed to the whole mass. It was with difficulty that the omentum could be separated, but when this was accomplished and the mass was separated from the lateral parietal peritoneum to which it was adherent, the retroperitoneal space was exposed and the right kidney was identified. At this point it was necessary to separate the tumor mass from the right ureter and the right iliac vessels. The entire ascending colon was separated from its blood supply, and the tumor, consisting of the cecum, the ascending colon, an adherent portion of the transverse colon, a portion of the omentum plastered over the tumor and the appendix which was within the mass, was removed. The terminal ileum and the transverse colon were brought out and an ileocolostomy established. In spite of the extensive resection, the postoperative course, temperature and respirations were those of a simple surgical procedure. Immediately after the operation a transfusion of 300 cc. of blood was given. The ileocolostomy functioned well, and the child was up in a wheel chair on the thirteenth postoperative day. The ileocolostomy closed successfully, the child gained about 20 pounds (9 Kg.), and when seen a year after the operation, she was in perfect health.

The specimen consisted of the proximal 30 cm. of ascending colon, including the cecum, the ileocecal valve, the appendix and 5 cm. of ileum. The region of the ileocecal valve and the appendix consisted of an irregular mass, 10 cm. in diameter. The appendix was completely surrounded by the tumor, and on sectioning into the mass, the appendical lumen could be demonstrated. The entire wall of the cecum was thickened to a diameter of 2.5 cm.

Multiple sections were made from the bowel in the region of the thickened mass. It was noted that the muscularis and the subserosal layers of the bowel were greatly thickened. The mucous membrane was of normal appearance. There was an infiltration of lymphocytes, plasma cells and polymorphonuclear leukocytes in the submucosa, occurring in definite foci. The muscularis portion of the intestine contained great numbers of spindle cells of stellate appearance. There was an abundant, fibrous, intracellular stroma with hyalinization. The stellate cells showed an occasional hyperchromatic nucleus; there was only an occasional mitotic figure. In a few areas lipomatous tissue was noted. It may be concluded from the microscopic study that we are probably dealing with a fibromyxosarcoma, associated with inflammatory and lipoid changes. This type of tumor is a malignant process of low grade; it would tend to local recurrence, but not to metastasis. The rapid recovery and continued health of the child eighteen months after the operation seem to confirm this statement. The resection seems to have been sufficiently extensive to have obviated a local recurrence.

(To be Concluded)

Book Reviews

Der Eisenstoffwechsel des wachsenden Organismus. By F. Thoenes and A. Aschaffenburg. Price, 6.50 marks. Pp. 103, with 20 figures. Berlin: S. Karger, 1934.

In this monograph Thoenes and Aschaffenburg present their work on iron metabolism and give a complete review of the literature. The critical discussion of both the literature and the authors' own work is highly interesting. The conclusions drawn are, for the most part, convincing, and the plan followed in the experimental work is logical and ingenious.

The chief object of study was the iron content of the blood serum, which was determined by the thiocyanate method. The normal range of the serum iron was established by determinations made on twelve new-born infants, forty normal infants aged between 2 weeks and 1 year, and twenty normal children between the ages of 2 and 9 years. For premature infants normal values were found, while in cases of chronic malnutrition the average values were somewhat higher than normal. Low values were found in anemias and also in some infections; in the latter condition the lack of correlation between serum iron and hemoglobin was striking. In experiments on animals (rabbits) it was shown that, of various iron preparations, ferrous chloride was the most effective in raising the serum iron content. This generally returned to normal within nine hours, and the question arose as to how the excess iron was taken out of the blood stream. Neither extirpation of the spleen nor blocking of the reticulo-endothelial system with thorium caused prolonged "hyper-ironemia" after the administration of iron, and the question as to removal of iron from the blood stream had to be left open. The interesting fact was found, however, that blocking of the reticulo-endothelial system with thorium lowered the serum iron content considerably. The authors correlate this fact with the decreased production of bile after such blocking and conclude that the serum iron must be chiefly the product of the destruction of normal blood. It is of interest that the injection of diphtheria toxin caused a drop in the serum iron content comparable to that obtained when the reticulo-endothelial system was blocked by thorium. Experiments made in order to find out whether the production of bile pigments was also decreased by the injection of toxins did not give definite results.

It is not possible in this brief review to touch on all the problems relating to the formation and destruction of blood, the function of the reticulo-endothelial system and other matters discussed in this work. The monograph should prove stimulating to further research in this field and valuable as a review of the literature.

Il bambino nell'arte visto da un medico. By Giuseppe Mazzini. Price, 80 lire. Pp. 363, with 297 illustrations. Milan: Ulrico Hoepli, 1933.

This book is a fascinating collection by an Italian pediatrician of pictures depicting the infant and child. It contains 297 reproductions of masterpieces of some of the world's great artists, ancient, medieval and modern. The book is divided into two parts, one dealing with the well child, the other with the sick child. In part one the child is seen at birth, at feeding, at play and in various emotional states. In part two there are sections dealing with the endocrine disorders, diseases of the skin and parasitic diseases, respiratory disorders, contagious diseases and death.

The pictures raise the interest by their varied appeal: some cause one to enthuse over the happiness of childhood; others impress by the pathos of the subject, and several are especially interesting because of their humorous aspects.

To one who does not understand Italian the book is worth while for its pictures alone. To one who can translate the text there is added pleasure in the description, the comment and the philosophy of Dr. Mazzini. The author shows that he has derived extraordinary pleasure from his hobby of collecting and evaluating works of art as applying to children. His medical eye has been keen in picking out pathologic features in subjects whom the artist may have chosen

or depicted as normal; thus, he finds children with adenoids, rickets, thyroid disease and other conditions. He especially stresses the morphologic types of Viola, Pende and Giovanni, so strongly emphasized in the Italian pediatric literature.

Seventh Annual Convention of the American Society for the Study of Disorders of Speech and First Annual Convention of the National League for the Rehabilitation of Speech. Dr. Elmer Kenyon, President. Nov. 25 and 26, 1932.

The seventh annual convention of the American Society for the Study of Disorders of Speech and the first yearly convention of the National League for the Rehabilitation of Speech were held in St. Louis on Nov. 26 and 27, 1932. Much good material was presented and considerable diversity of opinion expressed about problems in this highly specialized field. The dire necessity for complete and competent speech education in public and private institutions of learning was excellently stressed in the new program of speech education for the state of California. The sense of audition was portrayed as the paramount one relative to the correction of faulty speech. Case studies formed the basis of a research on the speech of the feebleminded and a paper on incipient stuttering in a preschool child. The dominant gradient theory as a cause of stammering was again questioned. The voice in a laryngectomized patient and faulty pronunciation and treatment of "s" and related sounds were themes of other papers. Between sixty and seventy attended, showing the growing interest in this new field.

Notes on Infant Feeding. G. B. Fleming. Cloth. Pp. 45, with 2 tables. Glasgow: John Smith & Son, 1931.

These notes were compiled with the object of aiding students in the art of infant feeding. The first fifteen pages are devoted to breast feeding and are excellent. The importance of this is duly emphasized. The first fifteen pages on artificial feeding could be omitted. This is a discussion of the basal requirements of a child, which is of no particular value and makes the subject more complicated for the student. A much simpler form of feeding calculation is in vogue at present. There are some interesting differences between feeding in Scotland and this country; certainly it is necessary here to give an infant more then two teaspoonfuls of cod liver oil to protect against rickets, and accessory foods are begun before the ninth month. The final part deals with the dietary treatment of feeding disturbances. Most of this is considerably behind the best usage. For example, in regard to the treatment of acute gastro-enteritis (summer sickness), this statement is made: "It is well to clear the bowels with a dose of castor oil (drachms ½ to 1)."

Lipoiden und Ionen. Eine allgemeine biologische und ärztliche Studie über die physiologische Bedeutung der Zell-Lipoide. By Prof. Dr. Rudolf Degkwitz, Direktor der Universitäts-Kinderklinik, in Hamburg; damals in Greifswald. Price, bound, 29.20 marks. Pp. 323, with 54 illustrations and 110 tables. Dresden: Theodor Steinkopff, 1933.

Referring to recent and earlier brilliant research on the etiology and treatment of rickets, Degkwitz describes his attempts to explain the development of rickets on the basis of early and recent observations of cell lipoids as chemical entities and as structural units of living protoplasm. After a discussion of lipoids and lipoid antagonisms, these compounds are discussed most interestingly from the point of view of all their properties in vivo and in vitro. The author concludes that he has failed to discover the mode of action of viosterol and the lipoidal building stones of cells, but feels comforted by the results of his investigations on the score of having thrown new light on lipoid actions. The book is of no immediate practical value to the pediatrician. To any one working in the field of lipoids it is a handbook of fact, containing an extensive bibliography.

Directory of Pediatric Societies

INTERNATIONAL

International Association of Preventive Pediatrics

President: Professor Taillens, Lausanne, Switzerland.
Secretary: Dr. P. Oltramare, rue Decandolle, Geneva, Switzerland.

FOREIGN

Royal Society of Medicine, Section for the Study of Disease in Children

President: Dr. Leonard G. Parsons, 58, Calthorpe Road, Birmingham, England.
Secretary: Dr. W. G. Wyllie, 33, Wimpole St., W. 1, London.

NATIONAL

American Medical Association, Scientific Assembly, Section on Diseases of Children

Chairman Dr. Alfred A. Walker, Highland Plaza Apartments, Birmingham, Ala.
Secretary: Dr. Ralph M. Tyson, 334 S. 21st St., Philadelphia.
Place: Cleveland. Time: June 11-15, 1934.

American Academy of Pediatrics

President: Dr. John Ruhräh, 11 E. Chase St., Baltimore.
Secretary: Dr. C. G. Grulee, 636 Church St., Evanston, Ill.
Place: Cleveland. Time: June 11-12, 1934.

American Child Health Association

President: Dr. Samuel McC. Hamill, 1822 Spruce St., Philadelphia.
Secretary: Dr. Philip Van Ingen, 125 E. 71st. St., New York.

American Hospital Association, Children's Hospital Section

President: Mr. Robert Witham, Children's Hospital, Denver.
Secretary: Miss Agnes O'Roke, Kosair Crippled Children's Hospital, Louisville, Ky.
Place: Philadelphia. Time: Sept. 24-28, 1934.

American Pediatric Society

President: Dr. Charles A. Fife, 2104 Spruce St., Philadelphia.
Secretary-Treasurer: Dr. Hugh McCulloch, 325 N. Euclid, St. Louis.
Place: Asheville, N. C. Time: May 3-5, 1934.

Canadian Society for the Study of Diseases of Children

President: Dr. H. P. Wright, 1509 Sherbrooke St. W., Montreal.
Secretary-Treasurer: Dr. R. R. Struthers, 1414 Drummond St., Montreal.
Place: Kingston, Ontario. Time: June, 1934.

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*Secretaries of societies are requested to furnish the information necessary to make this list complete and to keep it up to date.

Society of Pediatric Research

President: Dr. Rustin McIntosh, College of Physicians and Surgeons, Columbia University, New York.
Secretary-Treasurer: Dr. Charles F. McKhann, Harvard Medical School, Boston.
Place: Atlantic City, N. J. Time: May, 1934.

SECTIONAL

North Pacific Pediatric Society

President: Dr. Arthur H. Gray, 1117 Second Ave., Seattle.
Secretary: Dr. Raymond H. Somers, Cobb Bldg., Seattle.

Southern Medical Association, Section on Pediatrics

Chairman: Dr. Hugh L. Dwyer, 406, W. 34th St., Kansas City, Mo.
Secretary: Dr. Luther W. Holloway, 117 W. Duval St., Jacksonville, Fla.

STATE

Alabama Pediatric Society

President: Dr. C. E. R. Parker, 401 S. Court St., Montgomery.
Secretary-Treasurer: Dr. John W. Simpson, 1117 S. 22d St., Birmingham.

Georgia Pediatric Society

President: Dr. Joseph Yampolsky, 311 Doctors Bldg., Atlanta.
Secretary-Treasurer: Dr. Roger W. Dickson, 33 Ponce de Leon Ave., N. E., Atlanta.
Place: Augusta. Time: May, 1934.

Louisiana State Pediatric Society

President: Dr. Cecil O. Lorio, 245 Third St., Baton Rouge.
Secretary-Treasurer: Dr. Maud Loeber, Tulane University, New Orleans.

Medical Society of State of New York, Section on Pediatrics

Chairman: Dr. Adolph G. De Sanctis, 12 E. 11th St., New York.
Secretary: Dr. George M. Retan, 459 James St., Syracuse.

Michigan State Medical Society, Pediatric Section

Chairman: Dr. W. A. Collins, 103 W. Burdick St., Kalamazoo.
Secretary: Dr. Edgar E. Martmer, 749 David Whitney Bldg., Detroit.
Place: Battle Creek. Time: September, 1934.

Nebraska Pediatric Society

President: Dr. W. O. Colburn, 724 Sharp Bldg., Lincoln.
Secretary-Treasurer: Dr. C. G. Weigand, 1614 Medical Arts Bldg., Omaha.
Place: As announced by committee. Time: Second Thursday of each month from October to June, inclusive. Dinner at 6 p. m.

North Carolina Pediatric Society

President: Dr. J. Buren Sidbury, 15 N. Fifth St., Wilmington.
Secretary: Dr. E. K. McLean, 121 W. Seventh St., Charlotte.
Place: Various children's hospitals. Time: Twice a year.

Oklahoma State Pediatric Society

President: Dr. Clark H. Hall, 117 N. Broadway, Oklahoma City.
Secretary: Dr. M. J. Searle, 108 W. 16th St., Tulsa.

South Carolina Pediatric Society

President: Dr. Julian P. Price, Medical Bldg., Florence.
Secretary-Treasurer: Dr. Leland B. Salters, 317 S. Warley Ave., Florence.

Tennessee State Pediatric Society

President: Dr. Owen H. Wilson, 706 Church St., Nashville.
Secretary: Dr. Joe T. Smith, 702 Medical Arts Bldg., Knoxville.
Place: Chattanooga. Time: April, 1934.

Texas Pediatric Society

President: Dr. Sidney R. Kaliski, Moore Bldg., San Antonio.
Secretary-Treasurer: Dr. Frank M. Martin, 321 Medical Arts Bldg., San Antonio.

Virginia Pediatric Society

President: Dr. Thomas D. Jones, Medical Arts Bldg., Second and Franklin Streets, Richmond.
Secretary: Dr. W. A. McGee, 2618 Grove Ave., Richmond.
Place: Alexandria. Time: October, 1934.

West Virginia State Medical Society, Section on Pediatrics

President: Dr. R. C. Hood, 428 W. Pike St., Clarksburg.
Secretary: Dr. Russell C. Bond, 1325 Chapline St., Wheeling.

LOCAL

Academy of Medicine of Cleveland, Pediatric Section

Chairman: Dr. J. A. Garvin, Carnegie Medical Bldg., Cleveland.
Secretary: Dr. William M. Champion, 2323 Prospect Ave., Cleveland.
Place: 2009 Adelbert Road. Time: Four meetings, from September to May.

Academy of Medicine, Toronto, Section of Pediatrics

President: Dr. Gladys Boyd, 56 DeLisle St., Toronto.
Secretary: Dr. Lawrence Murray, 1870 Bloor St., W., Toronto.

Bronx Pediatric Society

President: Dr. Morris Gleich, 9 Post Ave., New York.
Secretary: Dr. Harry D. Pasachoff, 1560 Grand Concourse, New York.
Place: Concourse Plaza Hotel, 161st St. and Grand Concourse. Time: Every second Wednesday of each month, except June, July, August and September.

Brooklyn Academy of Pediatrics

President Dr. Carl H. Laws, 12 Pierrepont St., Brooklyn.
Secretary: John A. Monfort, 861 Carroll St., Brooklyn.
Place: Kings County Medical Society Bldg. Time: Last Wednesday of each month, except June, July and August.

Central New York Pediatric Club

President: Dr. Frank Vander Bogert, 111 Union St., Schenectady.
Secretary: Dr. Frank J. Williams, 58 S. Swan St., Albany.
Place: Various cities in New York. Time: Fourth Thursday of October, January and April.

Chicago Pediatric Society

President: Dr. Charles Schott, 48 W. Division St., Chicago.
Secretary: Dr. Bert I. Beverly, 8 S. Michigan Ave., Chicago.
Place: City Club. Time: Third Tuesday of each month.

Dallas County Pediatric Society

President: Dr. P. E. Luecke, 4105 Live Oak St., Dallas, Texas.
Secretary: Dr. R. S. Usry, 1835 Garrett Ave., Dallas, Texas.
Place: Bradford Memorial Hospital. Time: 1 p. m., first and third Saturdays of each month.

Detroit Pediatric Society

President: Dr. John A. Johnston, 2799 W. Grand Blvd., Detroit.
Secretary: Dr. Edgar E. Martmer, 749 David Whitney Bldg., Detroit.
Place: Wayne County Medical Society. Time: 8:30 p. m., first Wednesday of each month.

Fulton County Medical Society, Pediatric Section (Atlanta, Ga.)

Chairman: Dr. L. H. Muse, 384 Peachtree St., Atlanta.
Secretary: Dr. T. I. Willingham, 384 Peachtree St., Atlanta.
Place: Academy of Medicine, 38 Prescott St., N. E. Time: Second Thursday of each month from October to April, 8 p. m.

Intermountain Pediatric Society

President: Dr. Helmina Jeidell, 11 Exchange Pl., Salt Lake City, Utah.
Secretary-Treasurer: Dr. Edwin R. Murphy, 9 Exchange Pl., Salt Lake City, Utah.
Place: Salt Lake City, General Hospital. Time: First Thursday of each month, 8 p. m.

Kansas City (Missouri) Pediatric Society

President: Dr. Hugh L. Dwyer, 406 W. 34th St., Kansas City.
Secretary: Dr. John Aull, 906 Grand Ave., Kansas City.

Memphis Pediatric Society

President: Dr. Harry J. Jacobson, 1193 Madison Ave., Memphis, Tenn.
Secretary-Treasurer: Dr. Clyde V. Croswell, 1052 Madison Ave., Memphis, Tenn.
Place: Memphis General Hospital. Time: Second Tuesday of each month.

Milwaukee Pediatric Society

President: Dr. T. R. Janney, 1411 Wauwatosa Ave., Wauwatosa, Wis.
Secretary: Dr. John H. Reynolds, 1628 Wisconsin Ave., Milwaukee.
Place: Children's Hospital. Time: Second Wednesday of each alternate month, beginning with February.

New England Pediatric Society

President: Dr. James L. Gamble, 33 Edgehill Road, Brookline, Mass.
Secretary: Dr. Gerald Hoeffel, 319 Longwood Ave., Boston.
Place: Boston Medical Library. Time: Four meetings a year, occurring from September to May.

New York Academy of Medicine, Section of Pediatrics

Chairman: Dr. Martha Wollstein, Babies' Hospital of City of New York, New York.
Secretary: Dr. Harry Bakwin, 132 E. 71st St., New York.
Place: New York Academy of Medicine, 2 E. 103d St. Time: Second Thursday of each month from October to May, inclusive, 8:30 p. m.

Northwestern Pediatric Society

President: Dr. Alexander Stewart, 459 Lowry Medical Arts Bldg., St. Paul.
Secretary: Dr. E. F. Robb, 1801 Lyndale Ave., S., Minneapolis.

Philadelphia Pediatric Society

President: Dr. John D. Donnelly, 115 Bryn Mawr Ave., Bala, Pa.
Secretary: Dr. James E. Bowman, 4091 Comly St., Philadelphia.
Place: College of Physicians, 19 S. 22d St. Time: Second Tuesday of each month from October to June, inclusive.

Pittsburgh Pediatric Society

President: Dr. Henry C. Flood, 119 S. Highland Ave., Pittsburgh.
Secretary: Dr. E. R. McCluskey, Highland Bldg., Pittsburgh.
Place: Pittsburgh Academy of Medicine. Time: Second Friday, alternate months from October to April, inclusive.

Richmond Pediatric Society

President: Dr. W. A. McGee, 2618 Grove Ave., Richmond, Va.
Secretary-Treasurer: Dr. Emily Gardner, 1100 W. Franklin St., Richmond, Va.
Place: Richmond Academy of Medicine, 1200 E. Clay St. Time: First Thursday of each month (except July, August and September).

Rochester Pediatric Society

President: Dr. H. F. Rowley, 176 S. Goodman St., Rochester, N. Y.
Secretary: Dr. J. M. Parker, 26 S. Goodman St., Rochester, N. Y.
Place: Arranged by program committee. Time: Second Friday of each month from October to May.

Rocky Mountain Pediatric Society

President: Dr. Arthur L. Esserman, Republic Bldg., Denver.
Secretary: Dr. Ralph Verploeg, 19th and Gilpin Sts., Denver.
Place: Children's Hospital, Denver. Time: First Saturday of each month from September to May, inclusive, 7 p. m.

St. Louis Pediatric Society

President: Dr. Hugh McCulloch, 325 N. Euclid Ave., St. Louis.
Secretary-Treasurer: Dr. Katherine Bain, Beaumont Bldg., St. Louis.
Place: St. Louis Medical Society. Time: Third Friday of every month.

Seattle Pediatric Society

President: Dr. Armin C. Rembe, 1215 4th Ave., Seattle.
Secretary: Dr. Frank H. Douglass, Medical-Dental Bldg., Seattle.
Place: College Club. Time: Third Friday of each month, 7 p. m.

Southwestern Pediatric Society

President: Dr. James E. Harvey, 60 S. Lake Ave., Pasadena, Calif.
Secretary: Dr. E. Earl Moody, 3780 Wilshire Blvd., Los Angeles.
Place: University Club of Los Angeles. Time: First Wednesday in January, March, May, September and November.

University of Michigan Pediatric and Infectious Disease Society

President: Dr. John F. Sanders, 320 Townsend St., Lansing, Mich.
Secretary: Dr. D. Murray Cowie, University of Michigan, Ann Arbor, Mich.
Place: University Hospital, Ann Arbor, Mich. Time: Nov. 23-24, 1934.

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